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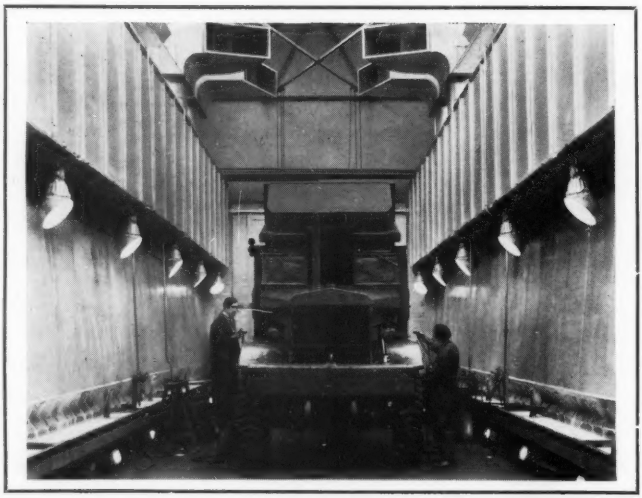

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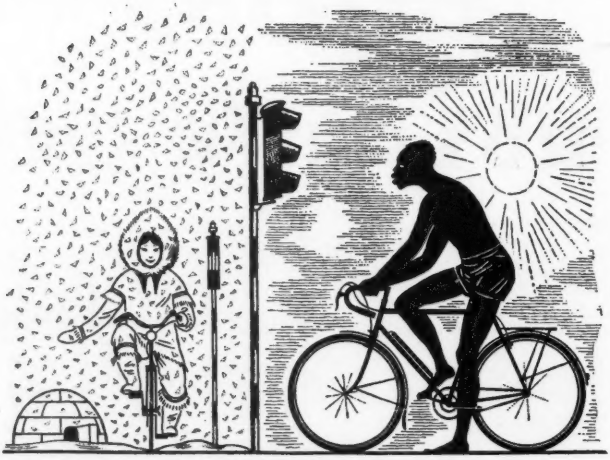

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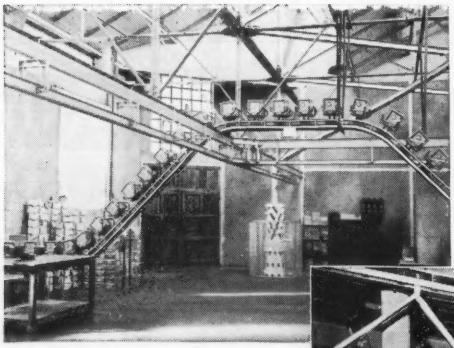
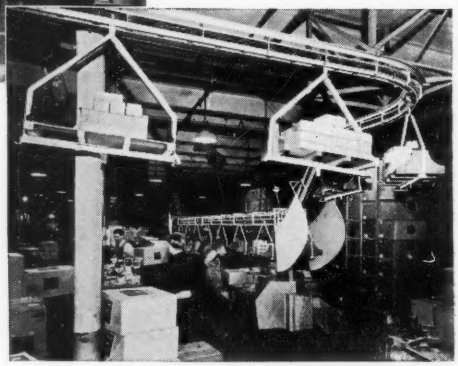
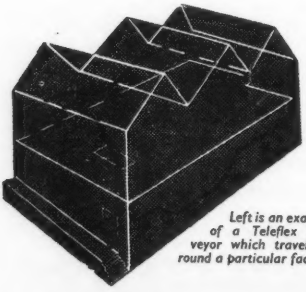


Left: The Teleflex dual-directional chain Conveyor adapted to carry tins of biscuits.



Right: Overhead chain conveyor carrying cigarettes in packing and despatch departments at the factory of Messrs. W. A. & A. C. Churchman.



Left is an example of a Teleflex Conveyor which travels all round a particular factory.

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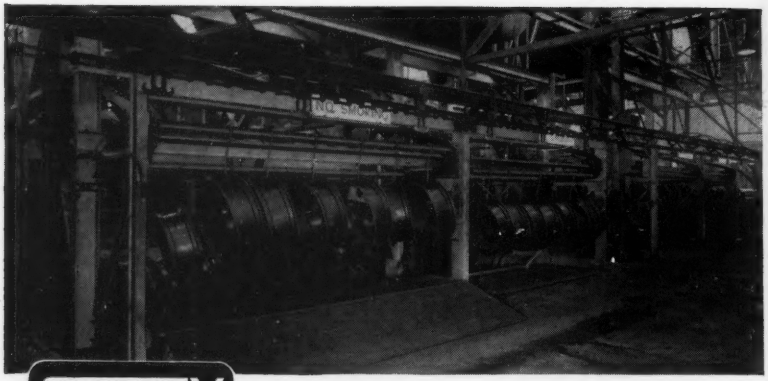

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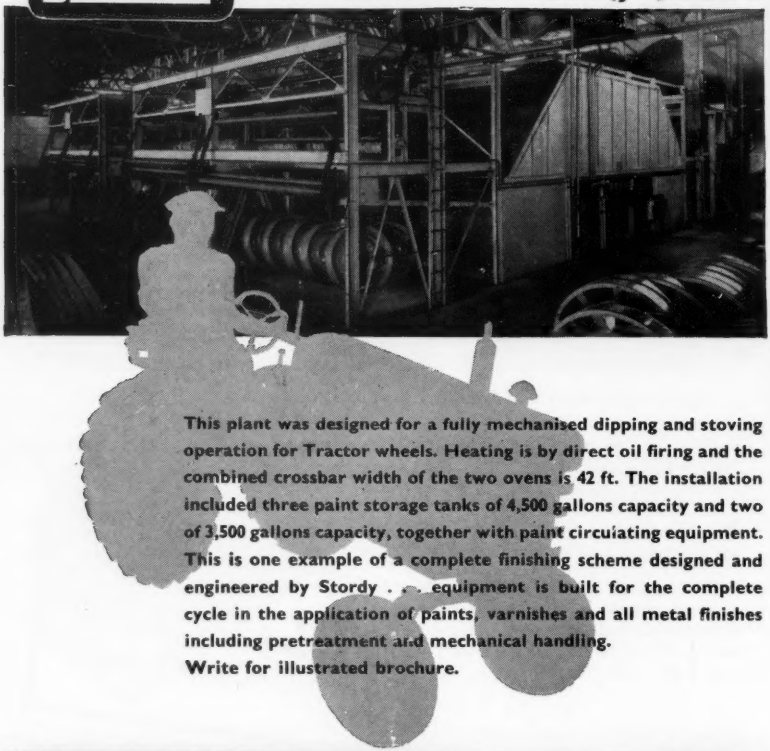

This plant was designed for a fully mechanised dipping and stoving operation for Tractor wheels. Heating is by direct oil firing and the combined crossbar width of the two ovens is 42 ft. The installation included three paint storage tanks of 4,500 gallons capacity and two of 3,500 gallons capacity, together with paint circulating equipment. This is one example of a complete finishing scheme designed and engineered by Stordy . . . equipment is built for the complete cycle in the application of paints, varnishes and all metal finishes including pretreatment and mechanical handling.
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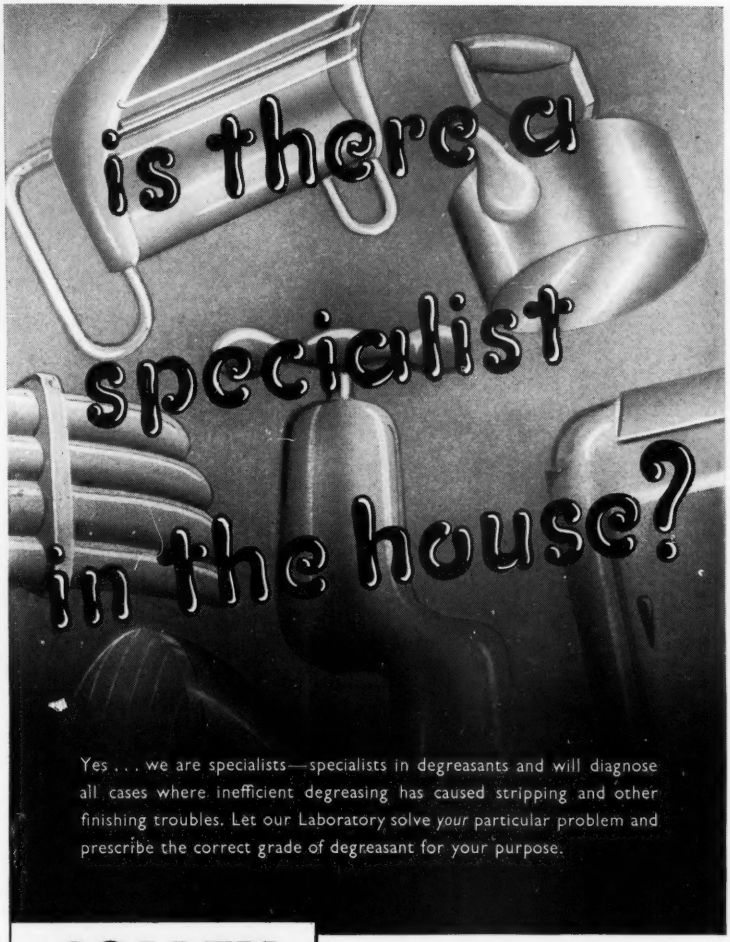

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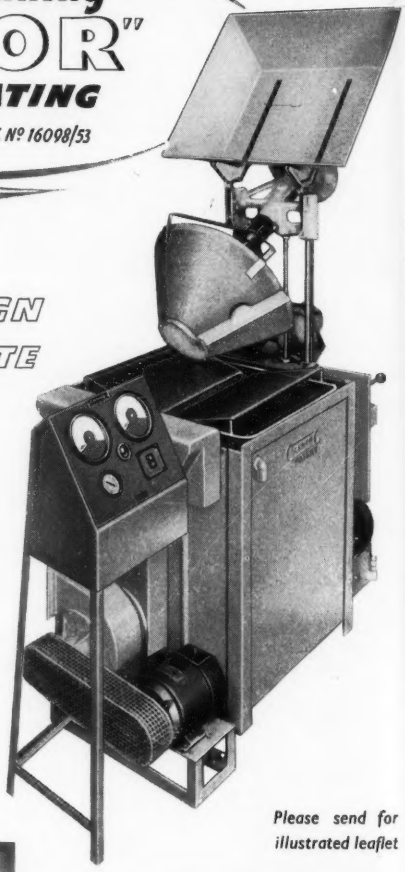

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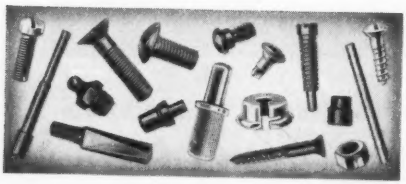

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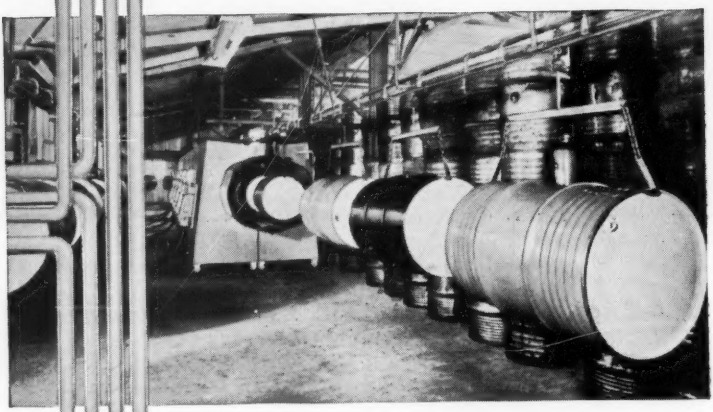

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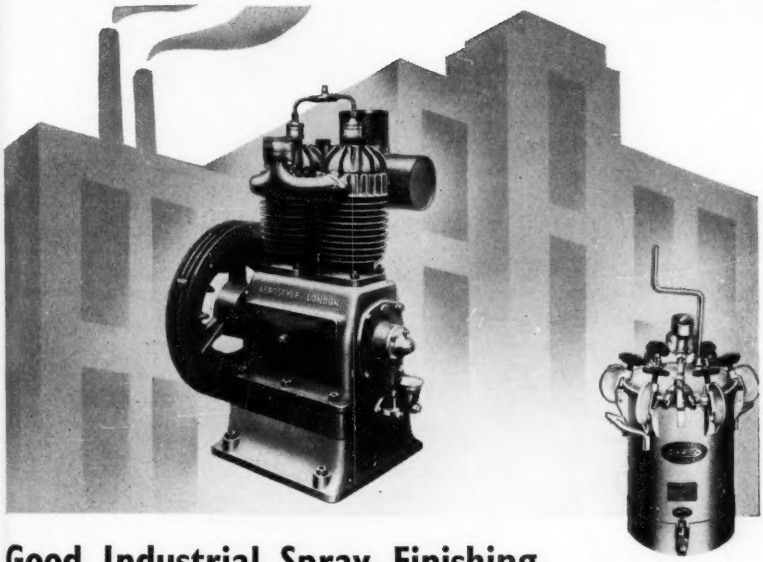

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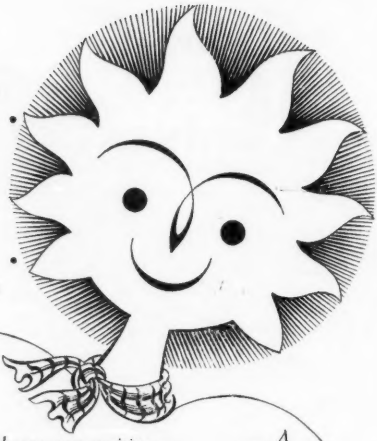

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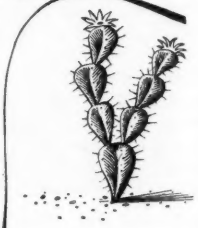

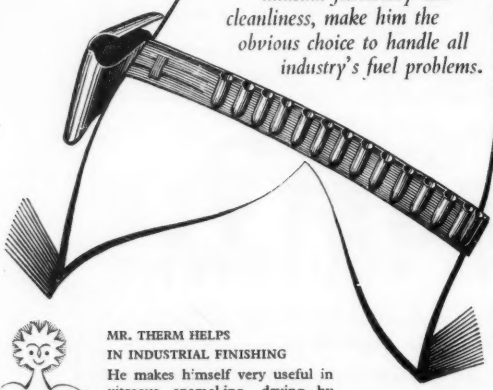

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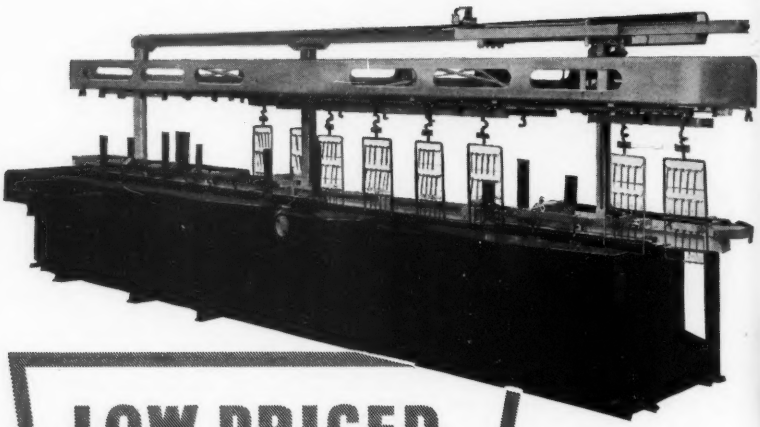

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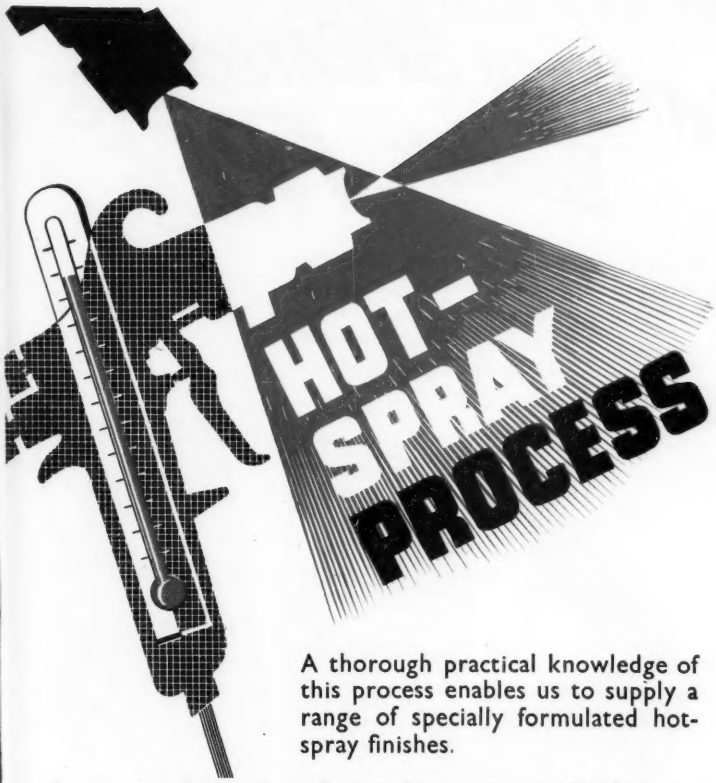

A thorough practical knowledge of this process enables us to supply a range of specially formulated hot-spray finishes.

It may be that you could use this process with advantage and if you would like to know more about its possibilities, we will gladly send a senior member of our Technical Staff for consultation and arrange a demonstration at our works.

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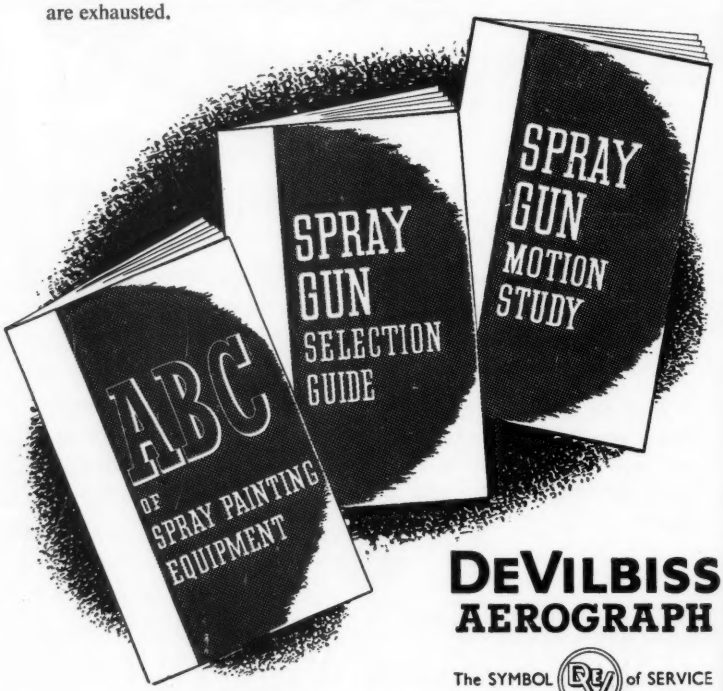

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INDUSTRIAL FINISHING

(Incorporating "CORROSION")

JANUARY 1954

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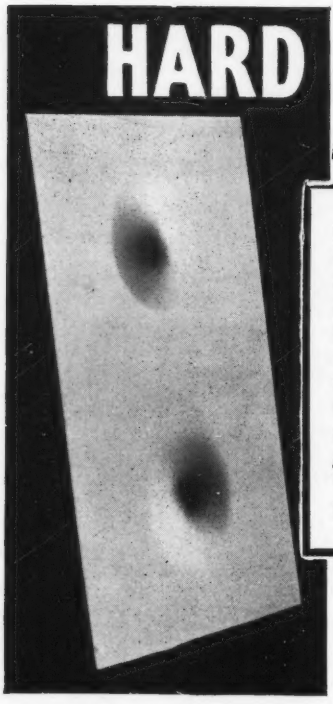
INTERNATIONAL

GROUP 28

STOVING FINISH



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Industrial Finishing

VOL. 6 JANUARY, 1954 NO. 67

AMBITION

IN an article in INDUSTRIAL FINISHING as far back as November, 1949, "Argus" said "I always thought that the members of the E.T.S. (as it then was) were humble fellows who just ensured that their electroplating was lustrous and bright and of the required thickness and stuck to the basis metal. Now it would appear that on them has fallen the cloak of Elijah and they are going to set forth to compete with the Faraday Society, the Institute of Chemistry, the Chemical Society, the Institute of Physics or—in hushed parentheses—'The Royal Society'."

"Argus" could have little knowledge of the future at that time. He is a technician not an astrologer! Nevertheless we could not help a little chuckle when we read the following in the current issue of the I.M.F. *Bulletin*. It refers to the Spring Conference of the Institute which, this year, is the fourth International Conference:

"The first evening will be marked by a banquet in the unique and incomparable surroundings of one of the Livery Halls, of the City of London, whose association with the old craft guilds have secured for them an everlasting place in the history of the capital. In these superb surroundings members can join in the full pomp and ceremony of a formal banquet such as only the City of London can provide."

We cannot help wondering how many of the rank and file of the I.M.F. will really enjoy "the full pomp and ceremony of a formal banquet. . . . in the City." We are ready to hazard a guess that they would prefer something a little less formal and a little more "matey."

On the Subject of Smells

The *Monthly Memorandum* (No. 118) of the Paint Research Station, touches on a problem that has often been a source of trouble in the past: the odour of paints. It poses the question; if the gloss, colour, viscosity and thixotropy of paint can be measured and recorded, why not the volume of its smell? It is realised by most people that the volume of odour in a paint can be of considerable importance and not everyone is familiar with the means of measuring it. In actual fact the best method of measurement is normally by means of an olfactometer. In using this instrument the operator starts with pure air and gradually increases the degree of contamination until he just recognises a slight smell. At this point the intensity is usually expressed on the *p*o scale where $po \pm \log_2$ (volume concentration of contaminated air), this being expressed as volume of contaminated air/total volume of the mixture at this initial stage.

The writer of the note in the *Monthly Memorandum* explains that the logarithmic scale is chosen as it correlates well with subjectively estimated odour intensities (Weber-Fechner law). The use of base 2 for the logarithms is largely a matter of convenience. The human nose can detect a difference of half a *p*o unit under favourable conditions but measurements to the nearest *p*o unit are usually sufficient for practical purposes. On this scale a particularly odoriferous paint specimen would give a reading of about six and a completely dried and aged specimen panel would have a reading of one. These instruments are marketed in the U.S.A. under the name of "Osmascope." Having measured your smell the next job is to make use of it

and, strange though it may seem, this task of putting smells to work is being taken up in many quarters. Mr. Geoffrey Lloyd, Minister of Fuel and Power, was asked in the Commons just before Christmas, what statement he had to make on the use of smells or, as the actual terminology of the question read, "stench agents" in the colliery industry for giving fire warnings in mines? He replied ". . . . the idea is novel but essentially sound; the principle is that overheating machinery would melt a capsule and this releases a powerful smell which would be wafted forward on the air and warn the miners of danger. The scientists have already devised two exceedingly foul-smelling chemicals. One smells overwhelmingly of garlic, and the other of garlic and skunk as well. These have both been successfully smelt by the experimenters a mile away."

Lest you should think all this is rather far-removed from the subject of finishing let us point out that many people find the smell of paint abhorrent, and several firms have produced special odourless paints. In America, as usual, they go further and make use of smells in the composition of paints and other manufactured products. According to our information the American technologist classifies his smells into four basic groups. Only one of these is a pleasant smell and is classed as "fragrant," the next is "acid" (sour or vinegary) the third "burnt" (roasted coffee, etc.), and the last one "goaty" (an unfortunate expression but one which aptly describes the group). Apparently the correct technique is to make use of the smells by blending one with another to obliterate the offender or modify its effect. Carrying the idea still further there is available on the American market, a range of foamed rubber products such as pillows, cushions and mattresses, which are so impregnated as to cause them to impart the scent of mountain air after a summer shower. The idea is good but we feel the day is still far off when we can refer to a dictionary of smells or consult a B.S.S. Code of Practice on the "Uses of Smells."

Watching Other People Work

In the course of a year we visit scores of factories where finishing of one sort or another is carried out, it is one of the most interesting aspects of the job of producing INDUSTRIAL FINISHING. Looking back at the end of last year on the various factories and the products passing through them, one thing struck us. The wide diversity of products and finishes and the many ingenious methods used in the application of finishing materials. We feel that it is always good policy, and nearly always instructive, to just watch someone else at work. One often sees new and novel methods of doing ordinary jobs and think how they could be applied to something else. Frequently we are guests and must treat what we see in confidence but on most occasions there is no secret about what is being done and the method can be used in another industry. Let us take an example; about a year or so ago we stood in a factory and watched broomsticks being dip painted in a novel manner. The paint was contained in a tube about 8 or 9 in. in dia. with a cap fitted at the bottom to make it into a hollow closed cylinder. Across the top of this cylinder was stretched a rubber diaphragm with six holes in it each a little smaller than the diameter of the broomstick. The latter, six at a time in a jig, were lowered into the paint and withdrawn, the rubber acting as a doctor knife. The finish could only be described as superb for the type of product. No tears, no blemishes, no runs and a continuous production, six at a time passing on to a large stand to dry. The idea is simple, a few weeks later we were able to suggest it to a maker of electrical fittings who wanted a quick satisfactory method of lacquering brass rods, he adopted it and was quite pleased with the results.

Can it be True ?

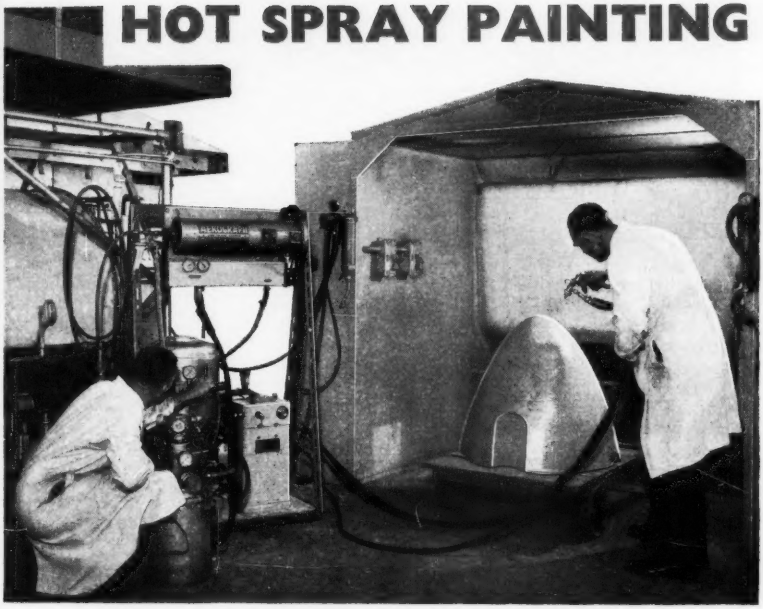
Turning to a lighter subject we recently picked up Mr. Denys Parsons new book* with the above title. This deals with the accidental omissions, misprints and errors which plague all who deal with the printed word. In it we found this extract from an Admiralty Instruction:

"It is necessary, for technical reasons, that these warheads should be stored with the top at the bottom, and the bottom at the top. In order that there may be no doubt as to which is the top and which is the bottom for storage purposes, it will be seen that the bottom of each head has been plainly labelled with the word "TOP."

The foregoing represents just one example from Mr. Parsons book, there are dozens of others equally humorous but the one quoted is the particular gem that tickled us. We smile at these obvious mistakes and wonder how they got into print yet, knowing from experience how easy it is we refrain from laughing too much. . . . who knows? Perhaps in this very issue. . . .

* *"Can It Be True?" by Denys Parsons, with illustrations by Anton. (London: Macdonald and Co., price 4s. 6d.)*

HOT SPRAY PAINTING



How to Control the Finish—from the Start

The great advantages of Hot Spray painting are only just being realised. For many industrial purposes the use of the pre-heating process will give an excellent finish much more quickly, with less labour and with an appreciable saving in cost.

For those who want to know more about it, the Demonstration Centre offers full facilities for practical demonstrations on customers' own products. What is more, we will gladly train paint-shop operatives at specially arranged short intensive courses—at no cost or obligation to the customer.

This is *your* opportunity to gain impartial and unbiased advice on the process that is revolutionising many industrial finishing procedures. If the process is suitable for *your* product, we will show you how best to use it. If it is *not* suitable we will save you expensive "trial and error".

The photograph shows a corner of the Demonstration Centre with operators hot-spraying synthetic enamels at the water-washed spray-booth. Three types of paint heaters are shown in the illustration. Take advantage of this "know-how" and let us help you to *control* your finish.

Just write to—

Demonstration Centre

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Flame Spraying of Ceramics

by

THOMAS A. DICKINSON

A "FLAME SPRAYING" technique now being developed by Ryan Aeronautical Co. at San Diego, Calif., is expected to permit the application of heat-resistant ceramic coatings on such materials as aluminium, magnesium, and titanium as well as iron and steel.

It consists briefly of pneumatically ejecting fine refractory powders through a flame with a spray gun of the type that has been developed for metallising purposes by the Schori Process Division of Ferro-Co. Corp., New York. The powders are temporarily melted by the flame, so that they can be bonded to various metallic surfaces without causing any appreable amount of oxidation.

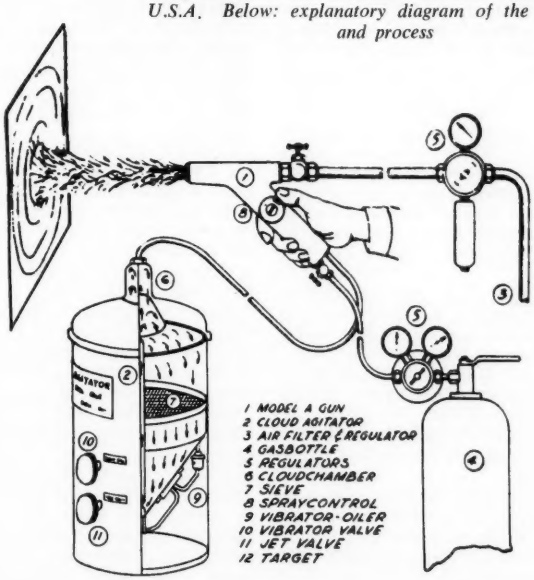
Besides permitting the use of ceramics on materials that could not previously be coated with refractories, this procedure eliminates the need for the dehydration ovens, furnace facilities, and much of the time that has heretofore been required to apply vitreous enamels.

It is unlikely that the process will replace conventional enamelling techniques because flame-sprayed coatings normally have a rather rough texture, which would probably not be acceptable on many commercial products. However, such coatings are as good as and perhaps better than standard ceramic finishes for strictly utilitarian purposes (that is, on components or products which must withstand extremely high operating temperatures) because they may comprise refractory materials with much higher melting temperatures than the metals to which they are applied.

While they have definitely proved that ceramics can be flame-sprayed on materials such as aluminium and magnesium without damaging the metals, Ryan engineers do not consider the new process a completely practical development for one reason: they do

Small parts can be flame-sprayed automatically in a lathe set-up of the type shown here

Above: exhaust systems of the type shown here are now being finished with ceramic material coatings in the U.S.A. Below: explanatory diagram of the equipment and process



Large surfaces are better treated by the use of a manually controlled gun as shown here

not yet have coating formulæ which will make it possible to apply ceramic fiinshes with approximately the same thermal expansion coefficients as those of most metals on which such finishes would be desirable.

For example, while it is now possible to bond a ceramic coating to the surfaces of an aluminium component, there is as yet no known refractory coating that will remain bonded to aluminium when the materials are heated enough to expand appreciably. This would not be an objectionable feature in finishing products that merely require high chemical resistance at room temperature, but it does limit the use of ceramic coatings on articles that require extra heat resistance.

At present, the only refractory finishing materials that are known to be suitable for use on metals which must withstand high operating temperatures are A-19, A-417, and A-418 compositions developed by the American National Bureau of Standards. These materials are suitable for finishing low-carbon steels, stainless steels, Inconels, etc.

However, aircraft engineers seem to be confident that research will eventually yield oxide combinations which will satisfactorily impart added heat resistance to virtually all metals.

Flame spraying will make the use of such materials practical because metals like aluminium, magnesium, and titanium would oxidize or melt before ceramic coatings could be applied to their surfaces with standard vitreous enamelling facilities.

Materials to be finished with flame-sprayed ceramics are cleaned and sand-blasted or chemically roughened in a conventional manner, prior to the application of ground and cover coatings.

Ground coatings are built up slowly by making a series of rapid passes over a surface area which is usually not more than a yard square, in order to avoid the excessive heating of deposition surfaces. Cover coatings are applied with about the same speed as metal-spray finishes.

Separate ground and cover coatings are normally applied in order to get maximum adhesion and desired colour effects. However, it is entirely possible that future developments will yield ceramic compositions which will respectively serve both ground and cover purposes.

Unlike metals, ceramic powders have no tendency to undergo a change in composition when they are flame-sprayed in open air because they are oxides from the start. Further, because they are chemically inert,

ceramic coatings will not ordinarily promote oxidation or corrosion in metals to which they are applied.

The primary purpose of ceramic coatings used by aircraft manufacturers at present is to conserve critical materials—for example, by permitting the use of mild steels in place of stainless steels where the heat resistance (but not the mechanical strength) of the latter is essential. However, in view of the fact that ceramics can be flame-sprayed almost as economically and efficiently as solvent-dispersed coatings, it seems at least probable that refractory finishes could be used for certain low-temperature applications where organic coatings have never been completely satisfactory—for example, in the protection of seaplane hulls and floats.

SCHOOL OF MATERIALS HANDLING

FOR some eighteen months courses of lectures on the handling of materials have been given by a team of lecturers, in many parts of the country, who have for years past specialised in this very important branch of production technology. It was realised, from the start, that these courses were but a palliative to more advanced and prolonged studies and steps have now been taken to provide more advanced and detailed courses. To do this it has been necessary to take over larger premises and an estate of some 17 acres has been procured in order to develop this educational work still further. It has been the aim of the founder from the time he launched the School of Materials Handling to set up a College where both theoretical and practical studies could be combined. This has now been achieved.

Curricula have been submitted and the names of College of Production Technology and School of Work Study have, in addition to School of Materials Handling, been officially approved by the authorities. This educational work is now being carried on under the title "College of Production Technology incorporating School of Materials Handling and School of Work Study."

The following are some of the courses and facilities now available through the college.

Full-time Three Term Courses in each of the following subjects:

Production Technology
Materials Handling in Industry
Cargo Handling—in collaboration with the International Cargo Handling Co-ordination Association.

Each course is of one year duration. Term times: May to July, September to December, January to March.

Part-time Evening Courses in each of the following subjects:

Production Technology
Materials Handling in Industry
Cargo Handling
Work Study.

These courses are of three-year duration. Term times: Same as for full-time courses.

Home Study Courses in each of the following subjects:

Materials Handling in Industry for Industrial Executives, Production Engineers, Factory Managers and Sales Engineers
The Design of Mechanical Handling Equipment for Estimators, Designers and Draughtsmen.

These courses may be started at any time.

Special Courses

In response to a number of requests, courses have and are being set up devoted entirely to specific industries as opposed to courses designed to cover the handling of materials in industry generally. The Principal is at all times prepared to consider the setting up of such courses both in this country and overseas.

Advisory Service

The Panel of the College is made up of both practical and theoretical experience and realize that many companies and individuals have handling problems. For this reason an advisory service has been set up to help solve them and the service is at the disposal of the whole industry. To those taking courses of study, the service is free but a small charge, depending on the size of the problem, is otherwise made to help support the educational work of the college. This service has already dealt successfully with 133 problems.

Further details of all the foregoing may be obtained from the Secretary, College of Production Technology, Swinford Old Manor, near Ashford, Kent.

As part of the practical work of the College, demonstrations of equipment are being arranged to which representatives of companies interested in this scheme and who may wish their equipment to be included in these demonstrations are invited to write to the Assistant Secretary of the College, marking their letters "Demonstration."

Reducing Costs in the Paintshop

"The spraygun operator holds in his hand an instrument capable of passing as much as 5s. per minute material value..."

by
A. RICE-WILLIAMS*

DEALING with this important subject in a paper read to the I.M.F., Organic Section recently,* the author pointed out that the finishing shop differs from any other department in the factory in that generally assembly and machining operations are a matter of a fixed set of conditions plus a time for performing certain operations, and the quicker those operations are completed the cheaper the cost of production. One cannot walk into a paint shop with a stop-watch, time an operation and hand the reins over to the operator.

He opened up his consideration of the factors involved by quoting a typical case. Recently a certain company requested a faster gun set-up, as the spray operator complained that he could not "earn his money"; a faster set-up was supplied and put into use. The operator and management were happy until permission was granted to carry out a cost investigation on the particular operation, and it was proved that, although the operation time was considerably reduced, the ultimate cost of finishing the article was exactly three times as much as it had been previously. He continued:

"It should always be borne in mind that a spray operator is holding in his hand a gun which is capable of passing anything in monetary value up to 5s. per min. If you even half this figure the hourly material rate is between £7 and £8, as against an hourly labour rate of, say, 5s. Usually the ratio of material value over-all to the labour value is somewhere in the region of 10 or 12 to 1. Surely the correct line of approach is to watch the material first, and then the labour.

"How often one sees a spray operator spraying into a booth at nothing in particular, but simply by force of habit testing the gun for performance, and no one is particularly worried, but if that operator took a quarter-of-an-hour's siesta on the shop floor he would be sacked! There is not so very much difference in the cost to the manufacturer. Let us suppose that an operator tests his gun for 5 seconds every half-hour; then he is wasting £90 or thereabouts per annum. Maybe it is more, maybe it is less, but it is a point to bear in mind.

"Until an operator complains, it is unusual for anyone to check his gun set-up, or the condition of the spray gun provided he is giving them the required finish. It is a point which must be watched if the paint shop is to be run at an economical level. In one case which was investigated last summer, the wastage due to wrong pressures, wrong set-up and spraying technique, by two operators, was on a basis of £2,577 per annum. I will enlarge on that. I have *personally* carried out tests which have satisfied me that one bad sprayer *can* cost, in labour and material, as much as fifteen good sprayers. The fault could be blamed on the sprayer, or the foreman, or material control, but the real onus should be on the on-cost control department."

The author then went on to point out that very few firms take any great interest in film thickness. He said that, for each article there must be a sensible production thickness according to the conditions it has to withstand. It is important that this thickness is specified, and periodical checks taken to ensure that the shops comply with

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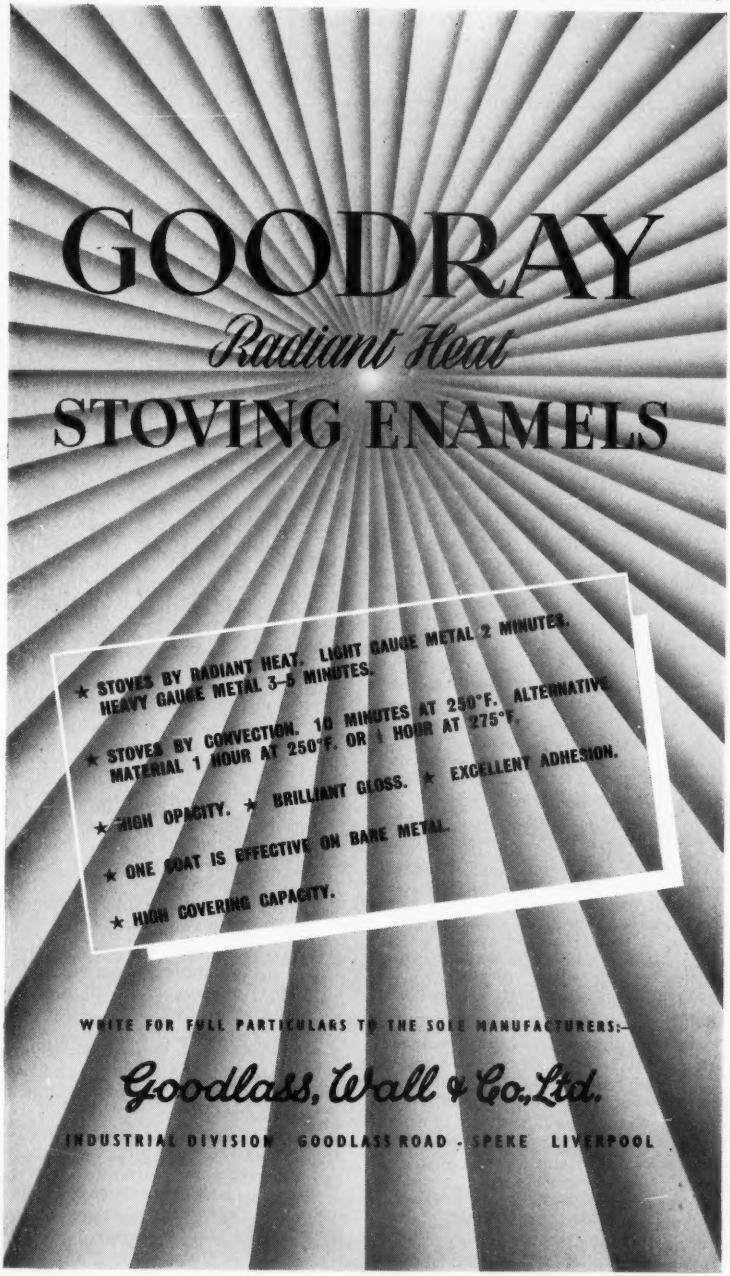
* *An abridged version of a paper read to the Institute of Metal Finishing, Organic Section, in Birmingham in November, 1953. With acknowledgments to the author and the Institute.*


GOODRAY
Radiant Heat
STOVING ENAMELS
★ STOVES BY RADIANT HEAT. LIGHT GAUGE METAL 2 MINUTES. HEAVY GAUGE METAL 3–5 MINUTES.
★ STOVES BY CONVECTION. 10 MINUTES AT 250°F. ALTERNATIVE MATERIAL 1 HOUR AT 250°F. OR ½ HOUR AT 275°F.
★ HIGH OPACITY. ★ BRILLIANT GLOSS. ★ EXCELLENT ADHESION.
★ ONE COAT IS EFFECTIVE ON BARE METAL.
★ HIGH COVERING CAPACITY.
WRITE FOR FULL PARTICULARS TO THE SOLE MANUFACTURERS:—
Goodlass, Wall & Co. Ltd.
INDUSTRIAL DIVISION . GOODLASS ROAD . SPEKE LIVERPOOL

the specified requirement. Taking a very simple example, suppose one takes a weekly consumption of 100 gall., a thickness of 0·001 in., and a paint cost of 30s. per gall., the annual total is £7,500; if the thickness on the same basis is 0·0015 in., the annual total is £11,250; for 0·0025 in. it is £18,750, and so on; which shows the importance of this point.

Apart from the various savings on productive costs, overheads must be carefully watched. Again, let us take an example. In one specific case it was noted that the operator was spraying exactly as he had been instructed for maximum economy, and it was found on test that he was averaging 1 pint in approximately 3 min., a weekly total of 110 gall. His total should have been 110 gall., and yet his actual total was approximately 21 gall., or just over 19 per cent. Over the three booths in the shop the average utilisation factor was 11·5 per cent. (which figure, strange as it may seem, is not at all unusual), due to the fact that the handling arrangements were poor, the shop layout was at fault, and the drying facilities were inadequate. It is often said by owners of small paint shops that they cannot afford conveyors. Let us analyse the above figure of 11·5 per cent over three booths. There is:

(1) 34,500 c.f.m. of extract air to heat, filter, and replace. (2) Current consumption of three fans. (3) Probably booth lighting. (4) Circulating pump, if water wash booths.	£600 per annum
(5) Pressure pot agitation.	

and perhaps £1,500 in wages, a total of £2,100, of which £1,850 is being wasted, and would make a very useful contribution towards a conveyor.

In certain cases it is not practicable to employ a conveyor, and in this case there is no reason why the spray gun cannot be hung on a suitable fan switch, so that the fan is only in operation when the gun is in use. It is, however, important, where possible, to avoid paying sprayers' rates for labouring costs.

Take another case of wastage in services, or overheads. This particular factory was utilising two 12 ft. × 12 ft. box type ovens for stoving sheet metal. The sequence of operations was to open the oven doors (thereby losing all, or most of the heat) for a period of 20 min. for off-load, followed immediately by a half-hour loading period, half-an-hour to get up to temperature, half-an-hour stove.

In this case the two box ovens were scrapped and one box oven erected at high level, with the bottom of the oven open. Underneath this, was erected an ordinary garage type of hoist, with a platform the same size as the oven. The raising and lowering took 1 min., there was no heat spillage, and labourers were loading a dummy platform while the previous load was being stoved. This meant that one 8 ft × 6 ft. did more work than the previous two together, with a saving of gas of £1,100 per annum, and a labour saving of £300 per annum. A useful figure towards the additional capital cost. These are one or two cases picked out at random from a very large number. During one investigation, fourteen different instances came to light. These were put right, giving a total annual theoretical saving of £45,000, out of a total cost of £108,500 per annum (including labour).

It might be of interest to present a comprehensive picture of the process of a cost survey, and the sequence in which it should be carried out. Let it first of all be fully understood that the general purpose of the investigation is to examine the finishing process, and to ensure that this process is being operated at its maximum effective economical level, and to eliminate any unnecessary wastage.

The investigation should be split up into three main functions:

(1) To determine the existing unit cost in labour, material, and a close approximation of the unit cost in overheads.
(2) To examine, and modify, where necessary, existing methods, materials, and facilities, and prepare a full record of recommendations.
(3) To institute a system of control to ensure that all modifications and recommendations are carried out as general practice.

No attempt should be made to reduce the existing quality of finish.

The author then went on to develop and enlarge on these three factors, giving a full description of the suggested methods of determining costs, calculating overheads and non-productive labour and fixing the scope and range of controls. He dealt with several points in which economies may be made such as pot pressures, fluid nozzle sizes, alternative methods of application, etc., and ended up by saying:

"It is surprising how very few firms, outside the motor industry, know accurately their finishing costs per unit or in total. They know what their paint costs are, but do not know what their paint costs should be. There are various ways of applying paint films. There is cold and hot spray, electrostatic deposition, tumble coating, dipping, roller coating, etc., and it is often difficult to know which method to adopt. There is, however, one golden rule. Know your existing costs exactly, and then you are free to try any other method, with the assurance that you will know exactly whether it is to your advantage economically. The question of quality is easier to judge than the question of economy.

"Before closing, I should like to emphasise the asset to a company of a good sprayer. If you have on your staff a good sprayer, one who will "trigger" correctly at the end of each stroke, use a Ford Cup regularly, and *not* spray cycle front forks with an 18-in. fan so that he can spray two at once, cultivate him, because his type are difficult to obtain. Hold on to him at all costs. Remember that, as well as a man being known by the company he keeps, a company is known by the man it keeps."

"ELEPHANTS ON THE STRATFORD ROAD"

UNDER the above title Cornish Bros. Ltd., 39 New Street, Birmingham, publish another book by A. L. Matthison whose intimate connection with Arthur Holden and Sons Ltd., is so well known. There is no doubt that Mr. Matthison to say the least is versatile. He has published technical books on finishing, two autobiographies, some sketches and essays of which two *This Desirable Residence* and *Ladies Long Loved* stand out, as well as work on fiction and drama.

In this book the author sits back and contemplates. He covers the theatre, travel at home and abroad, literature, poetry, whilst he recalls in vivid flashes the way of life in Victorian and Edwardian days. There is a combination of both philosophy and humour and wit in its truest form. In a delightful essay entitled *Song of the Shirts* he deals with totalitarianism. He guys the tendency in all dictatorships towards an increased population. He refers to "A chair of Fecundity" at the State University—he talks of their slogans—"Breed for the Defence of the Empire!"; "Every Male Baby a Future Soldier," and so on. He gives the dictator's "historic" speech:

"All praise to the mothers and woe unto the virgins! Virginity is a crime against the State. See to it, you women of Arianaria, erase the foul slander on your honour. Be producers, not drones."

There are many dabblings in the book and there is much fun.

PAINT TESTING EQUIPMENT APPEAL

A LETTER signed by Mr. T. Drummond Kerr, president of the Borough Oil and Colour Students' Association, appealing for funds to equip a paint testing laboratory in the new building of the Borough Polytechnic, London, was circulated recently and it is reported that £1,228 has, so far, been received toward the total target of £2,000.

The list is not yet closed, but the committee, which consists of representatives of the Society of British Paint Manufacturers, the London Colour, Paint and Varnish Manufacturers' Association, the London section of the Paint Manufacturers and Allied Trades Association, and the Oil and Colour Chemists' Association, expressed satisfaction with the response. Further contributions would be gratefully received by the secretary of the Borough Polytechnic, Borough Road, London, S.E.1, cheques to be made payable to the Borough Polytechnic.

PAINT FEDERATION JOURNAL

IN the December issue of the above journal is a photograph and notes about the new president, Mr. Ashley Hall; also photographs and a report of the annual dinner held in December.

A British Spraygun Artist

A note in a recent issue of "Industrial Finishing" describing the work of an American "spraygun artist" brought to us an invitation to see a British artist at work

SILICONE resins came from Britain and went to America, then they came back to Britain again as something new! Now De-Gayner's "Spraygun Artistry" comes from America as something new, according to "Industrial Finishing" October 1953.

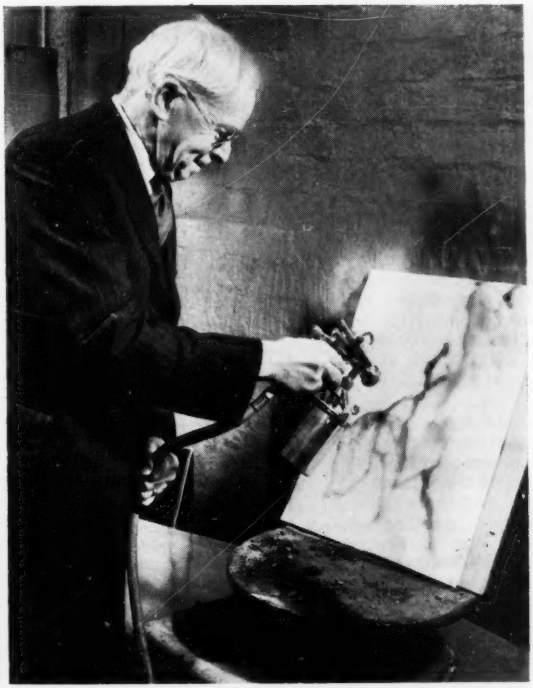
In reality Mr F. E. Webb, managing director of Aerostyle Ltd., demonstrated the "new" art in 1919! He made subsequently, some 200 pictures from then until 1937. Many of these pictures are in the possession of his friends today and are highly prized. In fact, the "Journal of Decorative Art" 1937, published some of them in the form of illustrations.

For Mr. Webb, the "canvas" is a brown paper sheet with a flat grey background; this enables him to create, by freehand spraying, his desired scenes or subjects. In his office at Acton one can see "spraygun pictures" some twenty years old.

Where hails Mr. Webb? From the Potteries, where he pioneered spray methods of decoration, learning his craft at the Longton School of

A random selection from the "Spraygun pictures" in Mr. Webb's office. A desert scene with palms, sand and rocks, a dockside view, a spray of leaves and, bottom right, a floating crane in a shipyard

Brixham harbour; a spraygun picture painted by Mr. Webb many years ago and kept as a typical example of what can be done



The artist goes to work to show us how he builds up the main lines of his picture

The outlines completed, Mr. Webb starts to put in the delicate veining of the leaves. Although the commercial spraygun is not as fine as the artists airbrush the result is quite remarkable

Art under the late, now revered, Wolliscroft Rhead. In 1910 he joined what was then the Airstyle Syndicate, a company formed to exploit the newly introduced German Patent Air Brush. World War I stopped the import of parts from German sources and Mr. Webb solved the problem of manufacture in this country, but that is another story.

As the business expanded and the name was changed to Aerostyle as we know it today, the activities of the company increased and included not only sprayguns but spraybooths and complete schemes for spray painting departments. In World War II his company was well established and played its part, like so many others in the practical application of the spraygun and equipment to the solemn business of helping to win a war.

In short, a well established spraygun business in Britain has emerged from the efforts of Webb the early spraygun artist.

We are sorry to have to de-bunk De-Gayner but the evidence shows that he was anticipated by about 30 years by an Englishman, Mr. Webb.

Although market trends indicate that raw material prices are going up, James North and Sons Ltd., Godley Mills, Hyde, Cheshire, manufacturers of P.V.C. fabric supported, industrial protective gloves, chemical, and foul weather clothing, are reducing glove prices by 12½ per cent. from the 1st January, 1954. A North spokesman stated: "this price reduction has been made possible by streamlining production to meet increased demands. This policy represents his company's contribution to the reducing or stabilising of prices and, it is anticipated, will be welcomed by many firms who expend considerable sums in providing effective protective clothing for their employees."

BRIGHT PLATING PROCESSES

An "Industrial Finishing" review of some of the processes for bright deposition of copper, zinc, nickel, white brass and chrome, which can materially help to lower production costs and reduce polishing and buffing times

BRIGHT plating processes are employed principally with the aim of reducing costs, eliminating hand or machine polishing, or speeding production. The economics of the processes have been discussed on many previous occasions and vast amounts of literature have been published on various individual processes. The three main factors that will interest the finishing shop supervisor, however, are: savings, advantages and disadvantages. We shall try to analyse these and, in the following pages, proceed to a discussion and description of the principal solutions and methods.

Savings: these are in the following categories, saving of material as no metal is polished off, therefore less need be deposited, savings on anodes, polishing compounds, jigs, current, vat and drying process fuel (steam or gas) saving of time in the polishing shop and saving of wiring, jigging and rewiring time between different baths, saving of polishing mops, sawdust for drying, and general handling charges from bath to drying off and to polishing shop.

Advantages are: speeding of production as only a slight buffing is necessary, if indeed it is even required at all, bright coatings are non-porous and, therefore, more corrosion resistant than dull, matt coatings, the effect of this is to lend an economic advantage, in that it is possible to get the same degree of protection with a much thinner coating. Another point is that the bright coating is characterised by a much greater hardness than is the standard plate, this gives it better wearing properties.

Disadvantages: there are, of course, a few disadvantages as with most industrial processes. Briefly they are the fact that very strict scientific control over the composition of the plating baths is essential, equipment necessary for some processes is expensive (rubber-lined tanks for bright nickel are an example), pressure filtration needs to be employed and air agitation apparatus of non-metallic construction is necessary. Most of the proprietary solutions for bright plating processes are, quantity for quantity, more expensive than standard solutions but the cost is, of course, recovered in the labour and time saved.

Fundamental principles. The basic principle on which most of the known bright plating processes work is the use of either organic or inorganic trace addition agents. These exert a refining influence on the plated deposit. The finer the grain of the deposit, the brighter will the coating become. During normal working bright metal nuclei are deposited along with the ordinary matt coating and, in ordinary functioning of the vat, the individual crystals of the deposit are larger than the shortest wavelength of visible light.

The function of the additives is to disturb the normal crystal growth and cause the production of a finely crystalline deposit in place of the larger crystals usually produced. The requirements for an addition agent are that it imparts brightness to the deposit over a fairly wide range of current densities, is relatively stable or that its products of decomposition do not exert an unduly adverse effect on the ductility of the metal deposited.

The factors which have most bearing on the quality of the deposited coating are: current density, bath composition, bath temperature, cleanliness of the equipment and solution and strict

control of the *p*H value. In all bright plating, whatever the final deposit or bright coating, it is necessary to use a little more care in the initial cleaning operation than for ordinary dull plates.

Bright Copper. Bright copper is usually applied to a smooth metal surface as a base coating on which to build a bright nickel-chrome final plate. It is used extensively on zinc-based die castings, not only as a bright deposit but also to prevent attack on the zinc as it goes into a subsequent acid nickel bath.

The copper solutions available can be divided into two main groups, acid and alkaline. The acid groups consist of the copper sulphate, copper fluoborate, etc., while the alkali solutions include straight copper cyanide, Rochelle and pink copper solutions. The cyanide copper solutions are essential for plating direct on to iron, steel and other ferrous alloys; also on zinc and zinc-based alloys as these metals cannot be plated directly in an acid sulphate bath. The sulphate solutions are generally used for such metals as brass, bronze, nickel silver, etc., and for building up heavy deposits in electrotyping, electroforming, etc. Ferrous metals can, however, be plated from the acid solutions provided they are first given a "strike" in a cyanide vat.

Many bright copper plating solutions have been advocated based on the acid bath. For example, F. L. Clifton and W. M. Phillips in America advocated the following electrolyte:

Copper sulphate ($CuSO_45H_2O$): 210 grm. per litre.
Sulphuric acid (H_2SO_4): 30 grm. per litre.
Molasses: 0·80 grm. per litre.
Thiourea (CH_4N_2S): 0·04 grm. per litre.
Current density: 70-75 amps. per sq. ft.
Temperature: 21° C.

Another bath advocated by the same writers is:

Copper sulphate: 250 grm. per litre.
Sulphuric acid (H_2SO_4): 10 grm. per litre.
Triton No. 70 (Wetting agent): 0·2 grm. per litre.
Thiourea (CH_4N_2S): 0·01 grm. per litre.
(Triton No. 70 is the salt of a sulphonated ether.)
Current density: 48 amps. per sq. ft.
Temperature: 21-27° C.
Vigorous agitation necessary.

The most popular bright copper bath, however, is the cyanide type which has good throwing power and needs only standard equipment. The Rochelle salt solution is a popular example of this class of copper bath, indeed it has been the workhorse of all copper plating establishments for many years past.

A typical Rochelle solution is as follows:

Sodium cyanide: (NaCN): 6 oz. per gal.
Copper cyanide (CuCN): 4·5 oz. per gal.
Rochelle salt ($KNaC_4H_4O_6$, $4H_2O$): 7·5 oz. per gal.
Sodium carbonate (Na_2CO_3): 2·5 oz. per gal.
Free NaCN: 1· oz. per gal.

The temperature range is from 140-160° F. and the *p*H should be 12.6; general operating conditions are:

Current density: 20-60 amps. sq. ft.
Voltage: 2-3 volts.
Cathode efficiency: 40-70 per cent.
Anodes: rolled annealed copper.
Anode area: two times cathode area.

Time to deposit 0·0001 in. at 140° F. is approximately 3·6 min. at 20 amps.; 2·2 min. at 60 amps. per sq. ft.

The free cyanide and the *p*H must be controlled within close limits if uniform results are to obtained. The carbonates should not be allowed to rise much above 9·6 oz. per gal., otherwise the anode efficiency may fall rapidly at high current densities. Steel tanks can be used but rubber-lined tanks are preferable.

Another solution which enables bright copper deposits of considerable thickness to be built up is the amine bath. Copper, plated from this bath can be used as an undercoating for bright nickel on such products as zinc-base die castings and steel pressings provided an initial flash from a cyanide bath is first given.

A typical bath of this class is the following:

Copper sulphate ($CuSO_4 5H_2O$): 20 oz. per gal.
Diethylene triamine (88 per cent.): 16 oz. per gal.
Ammonium sulphate ($(NH_4)_2SO_4$): 2 oz. per gal.
Ammonia (Sp. gr. 0·88): 5 oz. per gal.
Wetting agent (Tergitol ·08): 0·4 oz. per gal.
*p*H: should be 12·6
Temperature range: from 140-160° F.
Current density: from 30-50 amps. per sq. ft.

If direct nickel plating follows, it is essential to avoid carry-over of amines to the nickel bath as they cause severe trouble by embrittlement of nickel coatings.

The pyrophosphate is another bright bath which contains ammonia to render it alkaline and this bath is covered by an American patent (United Chromium Corporation). Its composition is as follows:

Copper (metallic Cu): 3·6-4·8 oz. per gal.
Pyrophosphate (P_2O_7): 25-33 oz. per gal.
Ammonia (NH_3): 0·24-0·48 oz. per gal.

Operating conditions are:

*p*H: 8·2-8·8.
Temperature: 110-140° F.
Cathode current density: 10-70 amps. per sq. ft.
Anode current density: 20-100 amps. per sq. ft.
Bath voltage: 2-5 volts, air agitation necessary.

The basic requirements are: steel tanks with rubber or other inert lining; continuous filtration; freedom from contamination by cyanide and lead and the use of an initial "strike" in a cyanide bath before plating.

In addition to the standard solutions and methods, there are, of course, a number of proprietary bright copper processes, such as the Cuprobright (Cannings) or the Cuprogleam (Cruickshanks). The latter firm also act as sole licensors for the Westinghouse P.R. system of bright copper plating.

Bright Zinc

Processes for the production of bright deposits on zinc have been developed on a considerable scale during recent years and the increasing cost and comparative scarcity of cadmium have led to the adoption of the bright zinc deposit as a practical alternative.

The reputation of cadmium is undoubtedly due to its beauty as a finish and this has always placed it well ahead of zinc on the grounds of appearance. The advent of the bright zinc coating, however, has enabled zinc to compete with cadmium on all points, including appearance.

Most of the bright zinc solutions are based on the cyanide bath, although one or two foreign developments, not in general use, are based on acid-zinc-sulphate electrolytes. A Russian suggestion is for a bath on the following lines:

$ZnSO_4\ 7H_2O$: 430 grm. per litre.
$Al_2(SO_4)_3 18H_2O$: 30 grm. per litre.
$Na_2SO_4\ 10H_2O$: 50-150 grm. per litre.
Add 3-5 grm. per litre of 2·6 or 2·7 sodium naphthalene disulphonate also a quantity of thiourea as another addition agent.
*p*H: 4-4·5.
Current density: 30-80 amps per sq. ft.
Temperature: about 75° F.

The principal objection would appear to be the rather bad throwing power of the acid-zinc electrolyte.

Most of the regularly-used cyanide solutions contain the usual components essential to the cyanide type of bath, viz., zinc cyanide, sodium cyanide and caustic soda. A wide range of "brighteners" is used. These are often one of the colloids commonly employed for brightening deposits, for example, glucose or gelatin type or, alternatively, complex aromatic or aliphatic organic materials. Typical such additives are: piperonal, vanillin, veratraldehyde, anisaldehyde or compounds of such metals as molybdenum, chromium, manganese, nickel, cobalt, etc.

The following is a frequently used bright zinc solution:

Sodium cyanide (NaCN): 9·0 oz. per gal.
Caustic soda (NaOH): 1·5 oz. per gal.
Zinc oxide (ZnO): 5·0 oz. per gal.
Sodium molybdate ($Na_2MoO_4 2H_2O$): 0·5 oz. per gal.
Thiourea (CH_4N_2S): 0·5 oz. per gal.

Operating conditions:

Temperature: approx. 140° F.
Current density: 15 amps. per sq. ft.
Anodes: pure, lead-free zinc.
Tank: steel, need not be lined.
Bright dip: 2 per cent. nitric acid for 10-15 sec. after plating and swilling.

This solution will give a bright deposit on steel but the articles are brownish in colour when withdrawn from the vat and the 2 per cent. nitric dip is essential to bring out the full brightness. The solution works at a fairly high current density and temperature and current density conditions need to be maintained fairly closely.

Another common solution is made up as follows:

Zinc cyanide: 4·6 oz. per gal.
Sodium cyanide (NaCN): 6·72 oz. per gal.
Caustic soda (NaOH): 12·6 oz. per gal.
Sodium sulphide: 0·12 oz. per gal.
Sodium polysulphide: 0·06 oz. per gal.
(Alternatively.)
Zinc dust: 0·36 oz. per gal.

The solution must be prepared in a *clean* steel tank. Add the required amount of caustic to the plating tank which has been two-thirds filled with warm (120° F.) water. After the caustic has been dissolved, add the required sodium cyanide and stir thoroughly to effect complete solution. Then dissolve the zinc cyanide. The bath is now ready for purification.

The bath is purified by stirring in the required amount of sodium sulphide or preferably sodium polysulphide previously dissolved in warm water. The bath is now ready for operation. If zinc dust has been used for purification because of copper contamination, it will be necessary to let the bath settle and either decant or filter before operation is started.

Operating Composition and Conditions

Metallic zinc: 4·5.
Total cyanide: 12·3.
Ratio of total NaCN to Zn: 2·74.
Temperature, ° F.: 75-95.
Current density, amps./sq. ft.: 5-50.
Average cathode efficiency, per cent.: 85.
Anodes: Electrolytic zinc, zinc magnesium or zinc aluminium alloy.

Solution Maintenance

Maintain the solution composition at ± 10 per cent. and the ratio of NaCN to Zn as follows:

Ratio NaCN to Zn	° *F.*
2·6	80-87
2·75	88-92
2·9	93-100

Caustic soda should be maintained within the recommended limits to obtain high cathode efficiency and lustre of deposits. Excessive sodium carbonate rarely accumulates but should be kept below 6 oz./gal. Daily additions of ·05 oz./gal. sodium polysulphide are recommended to keep heavy metals precipitated.

There are, of course, a number of proprietary processes and solutions on the market and reference to the advertisement pages of INDUSTRIAL FINISHING will give further details of these.

Bright White Brass Plating

An interesting bright plating method is that introduced a year or so ago by Electro-Chemical Engineering Co. Ltd. known as the Efco-Udylite, bright white brass solution. This is being used increasingly in the U.S.A. and, during the recent nickel shortage, it gained considerable popularity as an alternative to bright nickel. Normally the deposit of white brass is chromium-plated direct without any intermediate buffing operation and the resulting finish is almost identical in appearance to bright nickel and chromium.

Metal is deposited from a cyanide solution in the form of an alloy containing approximately 80 per cent zinc and 20 per cent. copper. As alloy anodes of a suitable composition are not available in this country, copper and zinc anodes should be used with separate electrical circuits.

In common with a zinc deposit bright white brass has the advantage of protecting steel anodically. In comparison with zinc it is superior in that it can be easily chromium-plated. It can also be claimed with justification that it has a better levelling action than zinc.

For recessed articles, difficult to cover completely with chromium, an added advantage is that any part not covered with chromium will not be so evident as when plated with chromium direct on copper or bronze. The covering power of chromium on white brass is superior to that of chromium on bright nickel.

The process is particularly suitable for articles subjected to relatively mild corrosive atmospheres. Components inside automobiles, indoor fittings and other articles requiring a decorative finish can be successfully plated in this process. Where corrosion resistance is of primary importance a preliminary copper deposit (·0002-·0003 in.) is recommended and a clear lacquer should be applied after chromium-plating.

The recommended composition of the bath is as follows:

Sodium cyanide: 14·5 oz. per gal.
Sodium hydroxide: 3·0 oz. per gal.
Copper cyanide: 2·5 oz. per gal.
Zinc oxide: 5·5 oz. per gal.
Efco-Udylite brightener "G": 2·5 fl. oz. per gal.
Efco-Udylite brightener "ZAD": 2·5 lb. per 100 gal.

Operating conditions.
Average deposit: 0·00025 in.
Plating time: 5-8 min.
Temperature: 75-90° F.
Cathode current density: 40-50 amps. per sq. ft.
Voltage: 4-6 volts.

Two proprietary brightening agents are used: "G," which is the principal brightener, and "ZAD," which in conjunction with "G" increases the bright plating range. Brightener "G" is supplied in liquid form; brightener "ZAD" is supplied as paste and is dissolved in warm water before adding to the solution.

Small additions of both brighteners are made at intervals; the use of the Hull cell is recommended to determine what additions of brighteners are necessary.

Equipment

A plain mild steel tank is used, preferably fitted with cathode rod agitation. Solution heating is not normally necessary but a steel cooling coil should be supplied. Filtration should be carried out at intervals. Separate electrical circuits for the copper and zinc anodes are required and should be fitted with suitable resistors.

Bright Nickel Plating. The two principal types of solution used in this country are those based on sulphonic acids (Schlötter) and those based on cobalt-nickel (Weisberg and Stoddard, Hinrichsen, etc.). One of the first solutions to be commercially applied was that of Schlötter formulated by adding aryl sulphonic acids (preferably polysulphonic acids) as brighteners to a Watt's type bath, and a typical example is the following:

Nickel sulphate ($NiSO_4.7H_2O$): 28 oz. per gal.
Nickel chloride ($NiCl_2.6H_2O$): 13·5 oz. per gal.
Boric acid (H_3BO_3): 3·2 oz. per gal.
Sodium Naphthalene Trisulphonate ($C_{10}H_5(SO_3Na)_3$): 5·6 oz. per gal.

Operating conditions:
Temperature: 100-120° F.
Current density: 20-30 amps./sq. ft.
*p*H: 3·8-4·0.
Anode: nickel 99-100 per cent.
Vat: rubber-lined steel.
Agitation: cannot be agitated owing to frothing.

Another Schlötter* bath is given below:

Nickel sulphate: 27 oz. per gal.
Nickel benzene-disulphonate: 5 oz. per gal.
Boric acid: 5 oz. per gal.
These quantities are dissolved in sufficient water to produce a *p*H value of approximately 3·5.

Operating conditions:

The solution is operated within a *p*H range of 2-5, the current densities normally employed being 30-50 amps. per sq. ft., although higher current densities are attainable for special purposes. The temperature may vary between 86° F. and 104° F. for the normal current density range. The process necessitates the use of good agitation and filtration, although the patentees* recommend that the agitation should not be violent.

All bright nickel baths are proprietary and are covered by patents although certain of the patents have expired or are on the point of expiry.

* *U.S. Patent No.* 1972693—(1934).

Investigation of the patent position should be made in all cases before commercially adopting any bright plating process.

A typical cobalt-nickel bath is the following, used under licence by many platers and due to Hinrichsen: (British Patent No. 461126, 1937.)†

Nickel sulphate ($NiSO_4.7H_2O$): 38·5 oz. per gal.
Cobalt sulphate ($CoSO_4.7H_2O$): 2·4 oz. per gal.
Boric acid (H_3BO_3): 4·8 oz. per gal.
Nickel chloride ($NiCl_2.6H_2O$): 7·2 oz. per gal.
Sodium formate ($NaCHO_2$): 5.6 oz. per gal.

Operating conditions:
Temperature: 130-140° F.
Current density: 20-40 amps./sq. ft.
Volts: 2·5-3·5.
*p*H: 4-4·3.
Anode: nickel 99-100 per cent, bagged.
Vat: rubber-lined steel.
Agitation: essential.
Constant filtration: essential.

This solution gives a fully bright lustrous deposit when depositing on a highly-polished surface. It is necessary, however, in order to obtain satisfactory results, to maintain all the operating conditions very accurately. Solution composition must be constantly checked by analysis and adjusted to the correct value, and the temperature and density maintained at the values given: *p*H control is also important.

The cobalt content in the deposit decreases with increasing current density as shown in Fig. 1.

Thus, in view of the high cost of cobalt, higher current densities are more economic.

In point of fact the great majority of the bright plating carried out in this country is done from baths operated under the Efco-Udylite process of the Electro-Chemical Engineering Co. Ltd., the Super Gleamax process of W. Canning and Co. Ltd., or the Perflo process of the American Harshaw Chemical Co., represented in this country by M. L. Alkan Ltd.

There are two Efco-Udylite bright nickel-plating solutions, these being designated as the No. 31 and the No. 31H baths respectively.

The No. 31 bath is basically a Watts type solution to which additions of brighteners and a wetting agent are made.

The No. 31H bath is a high chloride solution to which the same additions of brighteners and wetting agents are added.

The 31 solution is used principally on steel and brass. It has also been used for bright nickel-plating of copper-plated zinc base die-castings, but since its tolerance to zinc contamination is no better than that of the average Watts type bath, attempts were

† *Sole licensors Grauer and Weil Ltd.*

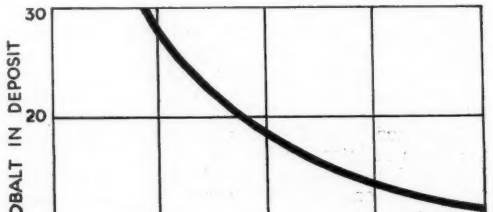


Fig. 1. Effect of plating current density on cobalt content of deposit from Weisberg and Stoddard bright nickel plating solution

made to find a solution which would be less susceptible to this type of contamination. The 31H or high chloride solution was accordingly developed and it is interesting to compare the maximum concentrations of zinc which can be present in either of the solutions without causing serious trouble.

The 31 solution can tolerate a zinc concentration of only 0·1-0·15 g/L of crystalline zinc sulphate, whereas the concentration of the same salt in the 31H bath can rise as high as 0·9-1·2 g/L. Thus the 31H solution will tolerate approximately nine or ten times as much zinc as the Watts type solution before it becomes necessary to carry out a purification procedure. It is for this reason that the use of the 31 solution for zinc base die-casting is no longer recommended, and the importance of this characteristic difference between the two solutions should not be overlooked, especially by those contemplating the bright nickel-plating of large quantities of zinc alloy die-castings.

With regard to copper contamination, the tolerance of both baths is the same, it being considered that concentrations of crystalline copper sulphate in excess of 0·1 g/L are definitely harmful.

The Electro-Chemical Engineering Co. Ltd., Weybridge, Surrey, have the sole rights for Udylite Bright Nickel solutions in the United Kingdom, Europe and Australia, R. Cruickshank Ltd., of Birmingham, act also as distributors on behalf of the Electro-Chemical Engineering Co. in Great Britain and Northern Ireland.

The Weisberg and Stoddard bath is similar, except that formaldehyde is employed, which acts as a depolariser. Here is a typical example:

Weisberg solution (British Patent No. 464814). Sole licensors W. Canning and Co. Ltd.

Nickel sulphate ($NiSO_4.7H_2O$): 38 oz. per gal.

Nickel chloride ($NiCl_2.6H_2O$): 7 oz. per gal.

Cobalt sulphate ($CoSO_4.7H_2O$): 2·5 oz. per gal.

Boric acid (H_3BO_3): 4·75 oz. per gal.

Ammonium sulphate ($(NH_4)_2SO_4$): 0·40 oz. per gal.

Nickel formate ($Ni(COOH)_2$): 8·0 oz. per gal.

Formaldehyde (HCHO) (40 per cent. soln.): 0·4 oz. per gal.

Temperature: 130-135° F.

Current density: 25-35 amps./sq. ft.

*p*H: 4-4·5.

Anodes: nickel 99 per cent. (bagged).

Vat: rubber lined.

Agitation: essential.

Constant filtration necessary.

Another bath of incidental, rather than practical interest, is the cold bright nickel solution. Its deposits are hard, brittle and very highly stressed and thick deposits are, therefore, liable to crack. Composition is:

Nickel sulphate: 19·2 oz. per gal.

Ammonium chloride: 3·6 oz. per gal.

Boric acid: 4·8 oz. per gal.

Operating conditions:

*p*H: 4·9-5·5.

Current density: 5-15 amps. per sq. ft.

Temperature: 75-95° F.

Bright Chromium Plating. The basic composition of all chrome-plating baths is chromic acid and sulphuric acid. The ratio of these two acids in the bath is of vital importance. The following is the usual composition:

Chromic acid: 60 oz. per gal.

Sulphuric acid: 0·6 oz. per gal.

In general practice the chrome is merely a "flash" over the undercoat of bright nickel, copper, etc., and its thickness is usually of the order of 0·00001 in. to 0·00005 in. Insoluble anodes of antimonal lead are usually employed and the anode to cathode ratio is of importance in reducing the tendency for trivalent chromium salts to build up in the solution.

Current densities of 100-200 amps. per sq. ft. are usually employed at voltages from 5-8 volts. Temperatures are from 100-110° F. The efficiency of a bright bath at this temperature does not usually exceed 10-15 per cent.

The bright chromium-plating bath operates with a critical current density. Lower current densities will give a milky deposit and a higher current density than the critical value will similarly give a milky deposit. Similarly, the bath temperature again is critical; low temperature and a tem-

perature above the optimum will also give a milky deposit. Although a less concentrated bath (in chromic acid) has a slightly higher current efficiency, in practice the high concentration bath will be found better to use because interference of the bath composition by dragout (particularly with regard to the sulphate radical) is less pronounced.

The surface of the work must first be prepared so that it has the appearance desired for the finished surface, i.e., it should be well cleaned and polished before plating. The development of bright copper and nickel-plating processes have rendered unnecessary any intermediate polishing stages, once the base metal has been prepared for plating.

TABLE 1

LIST OF PROPRIETARY BRIGHTENERS PATENTED IN BRITAIN AND U.S.A.

From this formidable list, remarks on the variation of the different addition products in relation to the mechanism whereby brightness is achieved can be well understood.

Patentee	*U.S. Patent No.*	*Brighteners*
Lutz and Westbrook	1,818,229	Benzyl naphthalene sodium sulphate
Pinner	1,837,835	Complex lead citrate
Pine	2,029,386 2,029,387	Sulphuric acid reaction products of oleo-resins and natural resins
Hull	2,085,754	Reaction products of alkali metal cyanides and certain aldehydes and ketones
Waite	2,112,818	Zinc or cadmium plus naphthalene-sulphonic acids
Harshaw and Long	2,125,229	Selenium plus sulphonates
Brown	2,191,813	Cd or Zn plus sulphonamides or sulphonimides
Lind, Harshaw and Long	2,198,267	Aminopolyaryl methane plus naphthalene sulphonate
	2,198,268	Aminopolyaryl methane plus single ring aryl sulphonamides and sulphimides
	2,290,342	Azo compound plus naphthalene sulphonates, single ring aryl sulphomides, or single ring aryl sulphimides
	2,238,861	Aromatic amino compounds plus an organic compound "Characterised by a ductilising tendency"
	2,326,999	Safranine compounds plus ortho benzoic sulphamide (saccharin) and its salts
ter Horst	2,361,720	Mercaptopyrimidines
Gaver	2,406,072	Starchates
Stocker and Freed	2,409,119 2,409,120	Sulphonated arylaldehydes Thiourea
Monsanto Chemical Co.	2,401,428	The sulphonation produce of hydrogenated biphenol high-boiler converted to nickel salts
Udylite Corporation	2,402,801	Thallium sulphate and ortho benzoyl sulphonamide and paratoluene sulphonamide
Seymour Manufacturing Co.	2,409,119	Ortho sulphur benzaldehyde
Seymour Manufacturing Co.	2,409,120	Thiourea
Dupont de Nemours	2,417,203	A soluble sulphurised gelatine

TABLE 1—*continued*

Patentee	*British Patent No.*	*Brighteners*
Schlötter	459,887	Aromatic sulphonic acids and alkali or alkaline earth halides
Mond Nickel Co. Ltd.	474,582	Egg albumen or blood albumen
Priston and Gardam	506,332	A monosulphonate with colloids such as gelatine, dextrin or lysablic acid
Parker-Wolverine	513,634	A soluble benzenedisulphonate with a soluble zinc salt
Udylite Corporation	525,848	Aldehydes or ketones
Udylite Corporation	525,847	Sulphonamides or sulphonimides with or without ketones or aldehydes
Houdaille-Hershey	526,966	Sodium formate
Houdaille-Hershey	526,967	Sodium formate and wetting agents
Houdaille-Hershey	526,968	Sodium formate and an inert anode
Harshaw Chemical	528,498	Triphenyl methane dyestuffs and aromatic sulphonate, a sulphonamide or sulphimide and the sulphate of a normal primary aliphatic alcohol with more than six carbon atoms
Udylite	529,825	An aromatic sulphonic acid group with a soluble indigoid dye with or without aldehyde or ketones
Harshaw Chemical	533,901	Triphenyl methane dyestuffs
United States Rubber Co.	554,335	The reaction product of sulphuric acid and 2-mercapto 6 methyl-4, 6 diethyl dihydropyrimidine
Udylite Corporation		A thallium salt plus an aryl sulphonamide, an aryl sulphonate or an aryl sulphinate
E. I. Dupont de Nemours	579,109	The hydrogenation products of reducing sugar

THE SMITHFIELD SHOW, 1953

Robert Ingham Clark and Co. Ltd., had the distinction of again being the only paint firm to exhibit at this show. Their stand contained models, photographs and applied samples of agricultural finishes and details of their services. Repaint work, correct colour matching and the pretreatment of the work were dealt with in the exhibit.

RECENT DEVELOPMENTS

MATERIALS : PROCESSES : EQUIPMENT

FIRE-RESISTANT DUCTING

FIRE-RESISTANT and abrasion-resistant ducting impregnated and coated with rubber or plastic compounds will be manufactured in Glasgow under an agreement which George MacLellan and Co. Ltd. of Maryhill and the Flexible Tubing Corporation of Guildford, Conn. have completed. Under this arrangement the Scottish company will manufacture for the sterling area a new product which has been named "Spiratube"; it consists of a helix of high carbon spring steel wire covered with a fabric of cotton, rayon or glass which is impregnated and coated with a finish to suit the specific purpose to which the ducting will be put. Rubber, neocrene, polyvinyl chloride and silicone polymer will be used according to purpose involved. Advantages which are claimed are extreme lightness in weight and portability. A standard 25 ft. length can be compressed to 3ft. and several of these can be carried by one man. The advantages for firefighting are obvious while specially-treated ducting can be used to carry highly abrasive dusts with success.

A new wholly-owned subsidiary of the Scottish firm has been formed under the name Flexible Ducting Ltd. to develop this project. Factory space has been allocated and modernised and an increased labour force is anticipated to meet the new development.

NEW PAINT SPECIFICATIONS

ON behalf of the Ministry of Defence, H.M. Stationery Office have recently published the following defence specifications for use of Government departments:

DEF-1035-A. 1. Paint, Priming, Red Oxide of Iron/Zinc Chrome; 2. Paint, Priming, Red Oxide of Iron/Zinc Chrome, Lead Free; 9th October, 1953 (superseding DEF-1035 and C.S. 2376D), price 1s., by post 1s. 1½d.

DEF-1036-A. 1. Paint, Priming, Red Oxide of Iron/Zinc Chrome, Stoving; 2. Paint, Priming, Red Oxide of Iron/Zinc Chrome, Stoving, Lead Free. 9th October, 1953 (superseding DEF-1036, C.S. 2092B, C.S. 2295, C.S. 2664A), price 1s., by post 1s. 1½d.

DEF-1047-A. 1. Paint, Enamel, Finishing, Exterior, Hard Gloss; 2. Paint, Undercoat, for Paint, Enamel, Finishing, Hard Gloss; 3. Paint, Enamel, Finishing, Exterior, Hard Gloss, Lead Free; 4. Paint, Undercoat, for Paint, Enamel, Finishing, Exterior, Hard Gloss, Lead Free. 9th October, 1953 (superseding DEF-1047. C.S. 2354, C.S. 2733), price 1s. 6d., by post 1s. 7½d.

The following varnish specifications have been published on behalf of the Ministry of Supply:

D.T.D.875. Clear Baking Varnishes for Heat Exchangers. Sept., 1953; price 6d., by post 7½d.

D.T.D.892. Pigmented Baking Varnishes for Heat Exchangers. Sept., 1953; price 6d., by post 7½d.

D.T.D.917. Method of Varnishing Heat Exchanger Matrices. Sept., 1953; price 1s., by post 1s. 1½d.

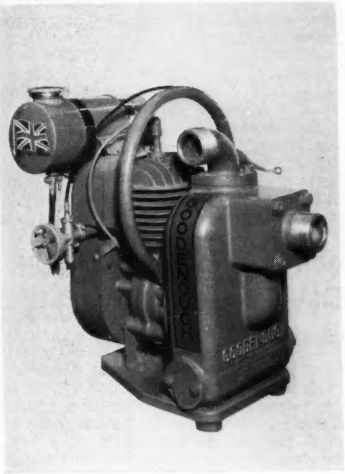
CENTRIFUGAL PUMP

THIS new motor-driven pump has been designed to meet the demand for a high performance pump at a price within the range of all. The pump is direct-coupled to an entirely new J.A.P. model 80 two-stroke engine, and the performance figures are as follows:

Maximum total head ... 110 ft.
Maximum output ... 4,000 g.p.h.
Guaranteed suction lift ... 25 ft.

The total weight of the complete unit is only 40 lb., enabling it to be easily carried by one person by the handle provided. The mounting is an alloy base-plate fitted with rubbers to absorb shock and to prevent "creeping."

The J.A.P. model 80 engine is fitted with a hand throttle control operated from the carrying handle. Thus, a range of outputs from a mere dribble to the maximum 4,000 g.p.h. can be obtained, thus really economical fuel con-



sumption is achieved under all pumping conditions.

An exclusive self-priming device is incorporated ensuring rapid automatic repriming up to a guaranteed suction lift of 25 ft. without the use of a foot valve on the suction hose. The unit will satisfactorily handle liquids containing up to 25 per cent. solids, liquid mud, paint, sewage sludge, slurry, oil and petrol, chemicals, etc. It is suitable for spraying, water supply, fuel supply, washing down, emergency fire fighting and innumerable other uses.

The new pump has been produced primarily to meet competition in overseas markets, and production is commencing immediately. Supplies are expected to be available for the home market in about four weeks.

Further details can be obtained from the manufacturers: Goodenough Contractors' Machinery Ltd., of Twickenham and Weybridge.

PLASTIC PROTECTION FOR PRINTING BLOCKS

PRINTERS' blocks, plates, electros, stereos, etc., have delicate surfaces liable to damage during the course of processing, handling and storage. The metals used for such blocks can be etched or engraved easily, and are therefore at the same time highly sensitive to the effects of air, oxidation, acid fumes, etc. This applies to most of the metals used for block-making, such as zinc, copper, lead, chromium, magnesium alloys, etc. For example, magnesium blocks, which are coming more and more into use, are very susceptible to corrosion.

In addition, the protection of engraved blocks is required against damage resulting from abrasion and impact, and also from the effects of accumulated dust and dirt during storage. When blocks that have been in storage for a considerable time are brought out for a reprint, they are given a wipe over, but it is very difficult in this way to remove any but the surface dirt and dust. The dirt and grit embedded in the orifices remains, gets on to the rollers and generally has an adverse effect on the quality of the printing.

Corrosion Ltd., 16 Gloucester Place, London, W.1, have developed for the protection of block surfaces a plastic coating that is applied cold by brushing, dries rapidly and can be stripped as a continuous film from the block surface immediately before it is put into use.

This material is known as Avigel 200. It gives a thick film in one application, which gives first-class physical protection against heavy knocks and blows and against abrasion, and for an indefinite period withstands every corrosive influence likely to be encountered in practice.

For example, the film is impervious to moisture and aqueous solutions and to water vapour. It is highly resistant to mineral acids of all strengths and to alkalis. It is also unaffected by most of the solvents normally encountered in practice. Grease and oils of all kinds have no effect on the film.

The material is supplied in clear or in tinted transparent colours. The surface of the block can be clearly seen when coated, and therefore no identification difficulties are encountered.

Stripping

When the block is about to be put into use, the film may be readily stripped from the block surface by lifting a corner and pulling, when the whole coating comes away in a continuous film, leaving the block surface absolutely clean. The cleansing effect of the material is quite remarkable, as it actually removes any dirt or dust that is already on the surface when the material is applied.

No difficulty will be found with stripping engraved surfaces of any description, and there is no tendency for the material to "key" into the crevices or apertures of the block.

The cost is very low. The material

costs about 2d. per square foot of surface coated. Application is of the simplest possible character—the material may be brushed (cold) on to the block surface without preparation of any kind, and only a single application is necessary. The coating is dry enough to handle in about 20 minutes after application. The coating is non-inflammable when dry, so there is no fire hazard resulting from its extensive use.

NEW PORTABLE COMPRESSOR

IT is not often that a new piece of equipment primarily designed for the builder, decorator, and contractor is first shown at an agricultural show, but such was the case with the latest addition to the compressor range of Maxim Engineering Ltd., the Maxim P.U.P. Major, which was first shown at the recent Smithfield Show on Stand No. 178, First Floor, Earls Court. The reason for this was that Maxim Engineering Ltd., who have recently moved their Head Office and works from Ladbroke Grove, London, to Twyford, near Reading in Berkshire, are primarily manufacturers of agricultural machinery.

This new compressor, however, has an output of 13.5 cu. ft. and a pressure of 15 lb. per square inch, yet it can operate two spray guns at the same time and also do a lot of other jobs, including hedge trimming, tyre inflating, etc.

Above: P.U.P. Major in use

Additional accessories are: paint spray gun, combined air separator and filter, grease gun, powder dusting gun, hose and special valves and hose connections. Price £110 5s. 0d. with petrol engine. £114 15s. 0d. with petrol/paraffin engine. Tractor mounted transport carrier £4.

The company's other two compressors, the Maxim P.U.P. Standard and P.U.P. Junior,, have been reduced by 10 per cent. in their price and now cost only £68 5s. 0d. and £50 8s. 0d. respectively.

BRIGHT ANNEALING 3-TON CHARGES OF COPPER STRIP

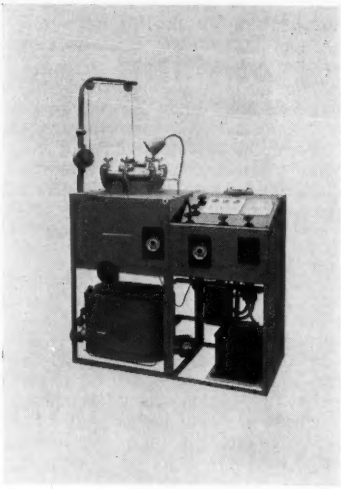
A NEW 275 kW, vertical cylindrical furnace, installed by The General Electric Co. Ltd. for the bright annealing of copper strip at the Kynoch Works of the Imperial Chemical Industries Ltd. is capable of handling charges weighing up to 3 tons. The furnace is of a type developed by the G.E.C. and now widely used for the processing of coiled ferrous and non-ferrous metals in controlled atmospheres. The charge is placed in a sealed container in which it is maintained in a controlled atmosphere throughout the process.

Economic use of power is obtained by a system of heat recuperation whereby as the container and its charge are removed from the furnace their heat content is used to preheat newly charged pots. The installation at the Kynoch Works of I.C.I. has forced air circulation to speed this transfer of heat and to give effective heat recuperation even at comparatively low temperatures.

Several containers, each more than 3 ft. in diameter and over 12 ft. in length, are used to permit a continuous cycle of operations during which the charge is maintained in an atmosphere of cracked and burnt ammonia. To ensure uniformity of treatment the atmosphere is circulated over the charge by a fan fitted to the lid of each container. The charge may consist of two or three coils which are stacked one above the other. Special handling gear is used to up-end the coils on to perforated carrier plates.

VACUUM IMPREGNATION UNIT

AN interesting impregnation unit has been introduced by Blickvac Ltd., high vacuum engineers of 505 Lordship Lane, London, S.E.22. Designed for the impregnation of electrical and similar apparatus to be followed by baking, the



The Blickvac unit

unit has an impregnation chamber designed and tested to withstand a pressure of 100 lb. per sq. in. This chamber is provided with a mechanically operated lid, and a sight window. A basket for holding the components for impregnation can be suspended under the lid.

The impregnation chamber is connected by vacuum lines to a Pulsometer 4 S.T.1. rotary vacuum pump obtaining a vacuum of 1 m.m. mercury over the entire system. The drive is by means of an F.H.P. motor and the starter for this is on the instrument panel.

The pump unit incorporates a combined condenser and vapour arrester which ensures full protection to the vacuum pump and allows dry air into the impregnation chamber.

The tank for pre-heating the impregnant prior to its admittance to the impregnation chamber is heated by a mineral oil bath, temperature range 40° C. to 160° C.

The whole system is mounted in angle iron frames and forms a single unit with special facilities for changing or adding additional impregnation chambers.

The plant is fully fused and self-contained and is designed to be plugged into the nearest convenient power point.

The equipment can be supplied with several variable features to suit individual cases and the makers issue a questionnaire to obtain the requisite information to enable the correct equipment to be selected.

INDUSTRIAL FINISHING LUNCHEON CLUB

THE Christmas meeting of the Industrial Finishing Luncheon Club was held on the 17th December at the Rembrandt Hotel. This is the fifth such luncheon and as was customary in the past the members approved that a cheque for £50 should be made payable to Dr. Barnado's Homes. This brings the sum total of the contributions from the Industrial Finishing Luncheon Club to this worthy cause to £200. The following letter was received from the General Secretary:

Hon. Secretary,
Industrial Finishing Luncheon Club.
Dear Sir,

Thank you so much for your letter of the 29th December, and the very welcome cheque for £50 which you have been good enough to send on behalf of the members of the Industrial Finishing Luncheon Club. It is so good of you all to remember the needs of our work so generously at this season of the year, and I can assure you that, although a little late for Christmas, your donation will be most valuable during 1954 in helping us to care for our large family and provide some of their many needs.

We remember with gratitude the many previous donations which you have sent from the Club, and I enclose the official receipt for this latest gift with the very warmest thanks of our Hon. Treasurer, which I should be glad if you would convey to all the members.

With renewed thanks, and with every good wish for the new year.

Yours very truly,
F. J. Potter, General Secretary.

Dr. Barnado's Homes,
Head Offices,
Stepney Causeway,
London, E.1.

To remind new readers it is pointed out that the Industrial Finishing Luncheon Club is an informal luncheon meeting and membership is from among technical and technical sales personnel in the finishing industries including paint, electroplating, galvanizing, etc.

Those interested in membership should apply to the Hon. Secretary, Dr. W. F. Coxon, at 157 Hagden Lane, Watford, Herts.

The club has been in existence for five years and meets about six times during the year. There is usually a guest speaker who is encouraged to be provocative. No record of the proceedings is taken and every member speaks as an individual and not as a member of his respective company.

Maintenance Painting

by

T. A. BANFIELD, Ph.D., F.R.I.C.
(of British Paints Ltd.)

PAINT is one of the methods of preventing the corrosion of metals, but the processes by which metals corrode may be classified according to their environment:

1. *Immersed Conditions.* Corrosion affected by: Dissolved salts, dissolved gases, acidity or alkalinity, marine growths.

2. *Underground Conditions.* Corrosion affected by: Water, dissolved salts, presence or absence of air.

3. *Atmospheric Conditions.* Corrosion affected by: Indoor exposure, dry or moist, outdoor exposure, clean or polluted, direct gaseous attack, tarnishing, high-temperature oxidation.

Various methods of prevention of corrosion are applicable to these different conditions. Thus corrosion inhibitors may be added to the water in car radiators, cathodic protection may be applied to metal structures buried in the ground or immersed in sea water, or resistant metals may be used for specialised chemical equipment. The most generally used method of preventing corrosion, however, is the application of some form of coating; this may be a fused coating such as vitreous enamel, a metallic coating such as galvanizing or an organic coating such as a rubber lining, a thick bitumen coating or a paint film. The latter kind of coating is only one of the possible means of corrosion prevention.

Design

The design of a structure should be investigated before detailed consideration is given to any kind of protective coating. For instance, crevices where moisture and dust are liable to lodge should be avoided, and structural members should be spaced so that it is not impossible to get a paint brush between them. If on the other hand such design features cannot be avoided, then it will be necessary to provide special protection at these places. Attention to minor points of this kind when a structure is still on the drawing board can save a lot of trouble and expense during its service life.

Painting steel

The general principles for the protective painting of steel are now fairly well known, and may be summed up as (a) good surface preparation (b) choice of a painting scheme suitable for the conditions of service (c) good painting conditions, and (d) application of a sufficient paint thickness. It might be mentioned that in America the Steel Structures Painting Council has drawn up specifications on surface preparation, pretreatment and paint application, and in this country the British Standards Institution has published a Code of Practice CP231 dealing with painting.

(*a*) *Surface Preparation*

As regards surface preparation, a clean, dry, slightly rough surface is the ideal for painting structural steelwork. It is much easier to state this requirement than to achieve it in practice, one of the chief difficulties being the removal of mill scale and rust. Pickling in acid gives a surface of the desired type, but, of course, can only be applied to steel before erection. The duplex pickling process in which steel is pickled in sulphuric acid, rinsed in hot water and then dipped into hot dilute phosphoric acid is being used to a greater extent; it has the advantage over an ordinary pickling process in

* *Paper read before the Edinburgh Branch of Incorporated Plant Engineers on 1st December, 1953.*

that it leaves a thin film of iron phosphate on the surface, and this provides a good basis for painting.

Sandblasting, shotblasting or grit-blasting also give an excellent surface for painting and whilst these processes are generally used before erection it is not impossible to treat structures after erection, although the labour charges are then high. Mention might be made of the Vacu-blasting process which can be used on structures after erection; this process recovers the steel grit by a vacuum system, and prevents any dust being released to the atmosphere. It has the disadvantage of being rather slow in operation.

Another process which gives a good surface for painting, and one which can be used after erection, is flame cleaning. This involves passing an oxy-acetylene burner over the surface. The sudden heating causes rapid generation of steam from any moisture on the surface and this tends to blast loose mill scale or rust off the surface: the heating also sets up differential expansion between mill scale or rust and the metal, again loosening them from the surface. After the passage of the burners the surface is wire brushed to remove the loose, powdery, dehydrated rust, and usually painted at once while the surface of the steel is still warm.

It should be noted that flame cleaning does not remove firmly-adherent mill scale, and hence the best procedure is to allow the steel to weather for as long as possible to loosen the mill scale, then flame clean and paint immediately before the structure is put into service. The surface produced by flame cleaning is not so good as that given by pickling or sandblasting, but sometimes in practice it is an advantage to be able to clean a structure after erection; the process can also be used to clean old steelwork. Several shipping companies have had the hulls of new ships flame cleaned; the work has been done on the stocks and has been followed by painting with suitable ship bottom paints.

Although pickling, sandblasting and flame cleaning are mentioned first it is unfortunately still true that the bulk of structural steel is not prepared for painting by these methods. Most steel is merely exposed out of doors for some time so that natural weathering undermines and loosens mill scale, which is then scraped or wire-brushed off. The process is slow and uncertain; according to the thickness of the steel, the rolling temperature and the weather conditions it may take anything from six months to two years to remove all mill scale, and even then the metal surface is left in a rusted and often pitted state. In practice removal of mill scale is rarely complete by this process and the steel is left with patches of mill scale adhering to the surface. These patches are usually undermined with rust to some extent, and altogether the steel is in poor condition for the application of paint.

Painting over such a surface usually gives results which are far inferior to those obtained by painting over a pickled or sandblasted surface.

Tests have been carried out on behalf of the British Iron and Steel Research Association at Sheffield, in which two coats of red lead paint followed by two coats of red oxide paint were applied over different surfaces. The duration of protection over a weathered and wire-brushed surface was 2·3 years, whilst on a pickled or sandblasted surface the corresponding figures were in excess of 9·6 years and 10·3 years respectively. These results were obtained by painting under good conditions and in practice I think it is unlikely that steel structures painted after pickling or sandblasting would be expected to remain in good condition for longer than say six years in an industrial atmosphere.

Surface washes based on phosphoric acid are sometimes used after weathering and wire brushing, the object being to convert the residual rust on the surface to iron phosphate. This compound is much more stable than rust and forms a better basis for paint. Whilst the use of these washes usually leads to some improvement it must be realised that the results obtained are not so good as from pickling or sandblasting.

(*b*) *Choice of Paints*

The main requirements of a protective painting scheme are that it must adhere to the metal, prevent spread of rust under the film from any damaged areas or edges, and resist breakdown as a result of exposure to external

corrosive agencies. Given good adhesion, paints protect iron and steel by two methods: there is the purely mechanical effect of preventing access of corrosive agencies to the metal, and there is also an inhibitive action whereby the surface of the metal is maintained in a non-reactive or passive state.

Priming paints for application direct to the metal are required to show good adhesion and to inhibit corrosion of the metal. The inhibitive action is obtained by including certain reactive pigments in the paint. These pigments include red lead, litharge, metallic lead, zinc or barium chromates, lead cyanamide, calcium plumbate and metallic zinc.

The inhibitive action is probably different for various pigments. Thus lead pigments form compounds by reaction with breakdown products of the drying oil of the paint, and these compounds inhibit the attack. Chromate pigments probably owe their action to their oxidising properties, which help to maintain a very thin film of oxide on steel surfaces, and cause its immediate repair in case of damage.

Zinc dust is another type of inhibitive pigment. Priming paints can be made containing 92-95 per cent. zinc dust in the dried paint film, and there is then metallic contact between the particles of zinc, and between the zinc and the underlying steel. When this state of affairs exists the zinc is preferentially attacked and affords electrochemical protection to the steel in the same way as a galvanized or zinc-sprayed coating. These primers are proving very useful in certain applications, but are expensive.

A priming paint which has been used for a very long time (it is said to have been used on Nero's barge), and one which gives excellent results, consists of red lead in linseed oil. This paint gives excellent protection which can hardly be improved upon, but it has certain disadvantages; it does not store very well, it is not easy to apply and for best results it is necessary to allow it to dry for at least a week before applying the next coats. Other priming paints now available do not share these disadvantages, and for most purposes the results are as good as can be obtained from red lead.

In particular it might be mentioned that red lead is not recommended as a primer for underwater steelwork. Its use may lead to severe pitting attack at damaged areas, and the film is liable to be broken down by chemical action of sea water. Special priming paints are manufactured for the bottoms of ships, and these give far better results than red lead.

The medium in which priming paints are made should be chosen according to the conditions of application and use. Oil paints are suitable for structural steelwork exposed to the atmosphere provided sufficient time can be allowed for them to dry completely. For industrial use quicker drying vehicles based on synthetic resins can be used.

Adhesion of most priming paints can be improved by the use of a "wash primer" or "metal conditioner." These coatings were developed from phosphoric acid surface washes, and contain vinyl resins which show exceptional adhesion to metal surfaces, chromate pigments to provide inhibitive action and phosphoric acid to etch and key the film to the metal. Wash primers must be applied thinly and the film produced improves the adhesion of almost any priming paint to most metals.

Paints applied after the priming coat need not contain inhibitive pigments, it being more important to have good hiding power and suitable colour. The finishing paint should be of such a nature that it is not affected by the corrosive agencies to which the structure is exposed, and in this way it will maintain the priming paint intact and in close contact with the metal. It is generally preferable for a finishing paint to be glossy because this prevents retention of dirt and moisture.

To prevent absorption of heat on oil storage tanks and such structures, aluminium finishing paints are frequently used because of their light and heat reflecting properties. Other industrial structures may have to resist acid or alkaline fumes, and suitable paints for these purposes are available. In some cases, too, the structures may be subjected to high temperatures and then it may be necessary to use special heat-resisting paints.

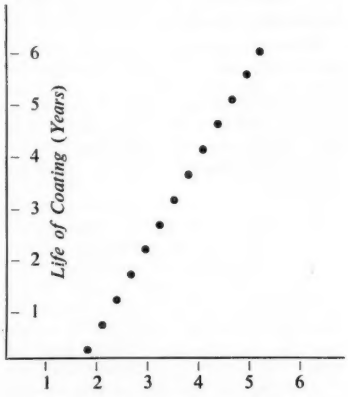
(*c*) *Weather*

The conditions under which painting

is carried out can make an appreciable difference to the degree of protection obtained. Ideally the surface should be completely dry, the relative humidity of the atmosphere should not exceed 80 per cent. and the temperature should be above 60° F. These conditions are rarely met in practice, particularly in this country but even so care should be taken to see that the surface is dry and that there is no likelihood of frost. It may be mentioned that wash primers tolerate the presence of a small amount of moisture on the surface, but even so, painting of moist surfaces is not to be recommended.

(d) Film Thickness

One of the most important points to watch in painting structural steelwork is that an adequate film thickness is applied. Recent results published indicate that the relationship between duration of protection and film thickness is approximately as shown in this figure.



These results were obtained from a large number of different types of priming paints applied over wire-brushed surfaces, and they show that increasing the film thickness from ·003-·005 in. leads to a considerable increase in the life of the coating. If we consider this relationship we see that extrapolation of the line to zero life indicates that a minimum thickness of ·0015-·002 in. is necessary before any protection at all is obtained.

It is likely that this is because a minimum thickness of paint is required to cover surface roughness, which may amount to about ·0015 in. Unless these surface imperfections are covered then unprotected parts of the metal will project through the paint film, and this will lead to very early breakdown. Similar results were also given by other authorities and these suggest that a minimum dry paint film thickness of ·005 in. is necessary under industrial conditions.

This figure provides a useful working rule, and I think it would be useful if I said something about measuring paint film thickness. Magnetic or electrical instruments are available, one of the simplest to use being the Elcometer. With these instruments it is necessary to wait until the paint is dry and fairly hard before a reading can be taken, so it is often preferable in practice to know what dry film thickness is obtained by applying the paint in use at a certain spreading rate. This figure can be calculated from simple constants of the paint, which are easily measured in a laboratory; alternatively most paint manufacturers would provide the necessary information.

A formula for calculating the average dry paint film thickness is:

$$t = \frac{1926}{S}\left(1 - \frac{Dv}{d}\right)$$

in which t = average dry paint thickness, thousandths.
S = spreading rate, sq. ft. per gall.
D = density of paint, lb. per gall.
d = density of volatile solvent, lb. per gall.
v = fraction of volatile solvent in the paint.

This formula has been applied to a few typical paints with the following results:

(i) Genuine red lead, B.S.1011 Type 1. Taking the spreading rate as 650 sq. ft./gall., the average film thickness is ·0023 in.
(ii) Yellow zinc chromate primer. Taking the spreading rate as 650 sq. ft./gall., the average film thickness is ·0015 in.
(iii) Proprietary undercoat. Taking

the spreading rate as 600 sq. ft./gall., the average film thickness is ·0018 in.

(iv) Proprietary finishing gloss paint. Taking the spreading rate as 700 sq. ft./gall., the average film thickness is ·0018. in.

Metal Coatings Plus Paint

A procedure which is capable of giving long-term protection to steel is the combination of a metallic coating followed by paint. For many years galvanized coatings have been used, particularly on roofing sheets, but the coatings which are now coming into more general use are of sprayed zinc or aluminium. Complete descaling of steel by gritblasting is an essential part of the metal spraying process, and this means that it is best performed before erection, although by portable blasting equipment touching-up can be carried out after erection.

The shop process has been mechanised, steel sections passing on a conveyor through a mechanical gritblasting chamber then beneath a bank of automatic metal spraying nozzles which apply ·003 in. thickness of aluminium. Application of paint seals the pores in the sprayed metal, and the combination of sprayed metal plus paint gives excellent results. This was demonstrated in some tests of the British Iron and Steel Research Association; sprayed aluminium followed by red oxide in linseed oil showing practically no breakdown after twelve years at Sheffield; the results from sprayed zinc followed by a similar paint coating were not so good.

Inhibitive paints are not needed over sprayed zinc or aluminium, but the surface is rough and porous, so care should be taken to see that a thickness of paint sufficient to cover the roughness is applied. Probably the largest application of such a composite protective scheme is at the new Margam works of the Steel Co. of Wales, where all the steel above crane track level, some 30,000 tons, has been aluminium sprayed and painted with aluminium paint.

Painting Non-ferrous Metals

The general principles for painting steel apply with certain modifications to other metals. Thus a clean, dry surface is required, and inhibitive priming paints should be used followed by undercoat and finishing paints suitable to the conditions of service. In the case of aluminium some etching of the metal surface is necessary to secure adhesion of the priming paint, unless a wash primer is used. (Wash primer is sometimes called self-etching primer because it does not require a separate etching treatment.)

Zinc sheeting and galvanized coatings also require an etching treatment unless it is possible to allow the metal to weather for about six months before painting. For aluminium the priming paints recommended are those containing chromate pigments; lead pigments are not suitable because there is danger of electro-chemical attack on aluminium.

In all cases an adequate paint film thickness should be applied, but ·003-·004 in. would normally be sufficient because non-ferrous metals such as aluminium or zinc are generally more resistant to corrosion than steel.

Repainting Schedules

Whilst the process giving the longest service life may be more expensive to apply in the first instance, it must be borne in mind that over a period of say twenty-five years it will be the cost and frequency of repainting which govern the over-all cost of corrosion prevention.

In the case of a steel structure painted after weathering and hand-cleaning the life of the system under industrial atmospheric conditions may be put at about three years. After this period extensive cleaning and repainting would be necessary to maintain the coating in a good state of repair. If, however, a regular schedule of cleaning and spot priming is carried out it should be possible to keep the paint coating in a good state of repair for much longer periods.

Regular touching-up at two-yearly intervals could be expected to extend the life of the coating to probably twelve or fifteen years before it would be necessary to clean the metal completely and repaint.

If the steel is flame cleaned and primed before erection and the finishing coats applied after erection, then a life of perhaps five years could be expected. By touching-up this type of coating every three years the life could

be extended to probably twenty-five years.

Steel which is pickled by the duplex process and primed before erection would give better service than either of the two preceding systems, and a life of perhaps six years could be anticipated. It would be preferable to touch-up this system every three years, but it is probable that the amount of cleaning and touching-up necessary would be less than with the flame-cleaned steel.

Steel protected by a sprayed aluminium coating followed by paint would have the longest service life of any of the systems discussed, and the amount of touching-up necessary would be comparatively little; even if the paint coating broke down completely the aluminium-sprayed coating would have a life in an industrial atmosphere approaching five years. It may reasonably be expected that touching-up with paint at five-yearly intervals would be quite sufficient for this system and in most cases only a little cleaning would be required.

Costs

Let us consider what would be the relative costs of these various schedules. Figures have been published from time to time of the actual costs but they show very wide variations according to the type of structure. I, therefore, think it best to put forward my own estimates, based partly on published figures and partly on my own knowledge of the processes. I realise that these are bound to be speculative, but I believe they are consistent relative to each other.

(a) Weathering and hand cleaning is not a cheap process because all the cleaning and painting is done after erection, and this means that labour charges are high. Suppose we say that the initial cleaning and application of three coats of paint costs 6d. per sq. ft., and that the cleaning, spot priming and painting at two-yearly intervals costs 3d. per sq. ft. The amount of cleaning and touching-up necessary will show wide variations on different occasions, but on the average may be taken as costing about half as much as the initial cleaning and painting.

Allowing for a complete cleaning-down and repainting after twelve to fifteen years, the total cost over twenty-five years is 45d. per sq. ft. made up as follows:

Initial cleaning and painting	6d.
Touching-up each two years, 11×3d.	33d.
Complete cleaning and repainting	6d.
	45d.

(b) Flame cleaning is a costly process owing to the expense of the gases used and because the labour must be more skilled than for hand cleaning. The cost of flame cleaning and priming before erection, followed by touching-up and applying two further coats of paint after erection might be taken as 12d. per sq. ft. The cost of flame cleaning would probably be reduced if the process were mechanised, but even so there is likely to be considerable variation according to the type of steel being treated, e.g., plates would be simpler to flame clean than sections.

On a three-yearly schedule the amount of touching-up would probably be about the same as suggested above, i.e., it would cost 3d. per sq. ft. The total cost of over twenty-five years is 36d. per sq. ft., made up as follows:

Initial cleaning and painting	12d.
Touching-up each three years, 8×3d.	24d.
	36d.

(c) With duplex pickling and immediate prime painting before erection, followed after erection by touching-up and applying two further coats of paint the over-all cost is generally no more than with hand cleaning and applying three coats of paint, all after erection. This is because labour costs for hand cleaning and priming after erection are higher than for the shop processes of pickling and priming.

Taking 6d. per sq. ft. for the initial treatment, it is to be expected that the amount of touching-up required at three-yearly intervals would be slightly less than with the two previous processes, so let us say 2½d. per sq. ft. Over a period of twenty-five years this leads to total cost of 26d. per sq. ft., made up as follows:

Initial cleaning and painting	6d.
Touching-up each three years, $8 \times 2\frac{1}{2}$d.	20d.
	26d.

(d) The cost of gritblasting and aluminium spraying by a mechanised process before erection, followed after erection by spot spraying and applying two coats of paint is not much more than that of hand-cleaning and applying three coats of paint, say about 8d. per sq. ft.

At five-yearly intervals comparatively little cleaning and touching-up would be required—let us take this as costing 2d. per sq. ft. The total cost over a period of twenty-five years is then 18d. per sq. ft., made up as follows:

Aluminium spraying and painting	8d.
Touching-up each five years, 5×2d.	10d.
	18d.

It will be seen that these figures show a considerable reduction in total cost of corrosion prevention over a period of twenty-five years, as more attention is paid to the initial surface preparation. The figures may seem surprising at first sight, but are in line with others published in recent years, and the general trend must be accepted.

Conclusions

Painting is one of the most widely used methods of corrosion prevention; experience and the accumulated results of research lead to the following recommendations for the most economical protection of structural steelwork in the atmosphere:

(a) Good service preparation is the main requirement. This involves complete removal of mill scale and rust.
(b) Choose a good painting system, commencing with an inhibitive priming paint and finishing with paints having any desired special properties such as heat reflectance, acid resistance, impermeability to moisture, etc.
(c) Apply paints to dry surfaces in an atmosphere of less than 80 per cent. relative humidity, at a temperature not below 40° F. and preferably above 60° F.
(d) Apply a total dry paint thickness of at least ·005 in.
(e) Composite schemes of metal coatings plus paint give exceptionally good protection.
(f) Maintain the paint in a good state of repair by a regular schedule of spot-priming and touching-up.

By the application of these principles the total cost of protective painting over a period of twenty-five years or more can be considerably reduced. In particular, by using a sprayed aluminium coating followed by paint it should be possible to obtain good protection at about half the over-all cost of weathering, wire brushing and painting.

SULPHURIC ACID AND SULPHUR DIRECTORATE ENDS

IN view of the revocation, at the end of December last, of the statutory controls on sulphuric acid and on sulphur used in its production, the Ministry of Materials has announced that the Directorate of Sulphuric Acid and Sulphur Supplies, at Lacon House, Theobalds Road, London, W.C.1, closed down on 31st December, 1953.

From 1st January, this year, any inquiries on matters previously dealt with by the Directorate should be addressed to the Ministry of Materials, Branch 2A, Horse Guards Avenue, Whitehall, S.W.1.

EXHIBITION OF ANTI-CORROSIVE METHODS

THE Corrosion Group of the Society of the Chemical Industry are organising an exhibition of methods used to combat corrosion of iron and steel. The exhibition will be held in the Great Hall of Battersea Polytechnic, London, on Friday, 22nd January, from 10 a.m. to 4.30 p.m. It will not be a trade exhibition, but a demonstration of protective processes. Admission will be free.

Methods and processes for the prevention of corrosion of iron and steel will be demonstrated in five main sections: Effect of design, treatment of the corrosive medium, cathodic protection, protective coatings, and tests and methods of testing.

LETTERS TO THE EDITOR

SIR,—We have read with much interest your article on the chemical treatment of ships' hulls, dealing with a Walterisation R.S. product. We should, however, like to bring to your attention two apparently conflicting statements which appear on page 261—as follows:

(a) "It must be emphasised, of course, that the treatment is only applicable to new construction in the shipyard."

(b) "The fact that it is designed for use on rusted steel makes it particularly suitable for marine work as the steel plates used in the shipyard are invariably rusty, this is the natural result of them being left out in the open during building."

These two statements, surely, comprise a contradiction in terms? If the Walterisation method is only applicable to new construction, why the emphasis on rusted steel work? The biggest problem in the shipyards today is that the demand for heavy plate is greater than the supply; with the result that the steel plates are either riveted or gas-welded to the ship with an unbroken and tightly adherent film of mill scale. This scale must be removed prior to the application of any chemical pre-treatment.

We feel that this is not consistent with the claim that the success of their chemical treatment is due to the steel work being already rusted. If the steelwork *is* rusted (and this is apparently the desirable condition), why is the process applicable only to new construction, since all the rust that could be desired may be found on old ships requiring repainting and maintenance?

It is possible that the well-known tyranny, "exigencies of space," did not permit of a more adequate description; nevertheless, we should be grateful if the conditions for the application of this process could be satisfactorily explained.

Yours faithfully,
For JENOLITE LTD.
PETER EARL.
Publicity Department.

A copy of the above has been sent to The Walterisation Co Ltd., who have sent the following reply:

SIR,—In reply to the letter from your correspondent, it should be explained that Walterisation Foscote R.S. solution has been designed for use on rusty steel. In the construction of ships, whilst it is true, as your correspondent points out, that heavy plate is in short supply, the time for building a ship, even when reduced by the most modern production methods, is still such that breakdown of the adherent mill scale has occurred by the time the ship is ready for painting. The plates are coated with a film of rust and present an ideal surface for treatment by Foscote R.S.

However, this correspondence does afford the opportunity of mentioning an interesting feature of the use of Foscote R.S. If the solution is brushed on to steelwork which has a coating of mill scale, and left to weather for a period of a week or two, the mill scale will now form a very loose coating which can be readily removed by light wire brushing, leaving a thin rust film underneath which is ideal for treating with Foscote R.S. again.

We would point out that the wording in the original article on page 261 due, as your correspondent explains, to the "exigencies of space" is slightly misleading. The sentence "It must be emphasised that the treatment is only applicable to new construction in the shipyard" should read ". . . treatment is best applied to new construction in the ship yard. The process can, however, be used with beneficial results on old construction already painted."

The most suitable procedure in such cases is to brush on Foscote R.S. over the whole surface and allow it to remain until the unpainted areas appear dry. The whole surface should then be swabbed down with water to remove the Foscote R.S. and allowed to dry thoroughly prior to the application of the paint.

This technique does not produce the full protective value of the Foscote R.S. treatment and should only be used in cases where patches of adherent old paint are present.

Yours faithfully,
p.p. THE WALTERISATION CO. LTD.
W. E. CATTLEY.
Sales Manager.

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Preservation of Paints

by A. E. WILLIAMS, Ph.D., F.C.S.

WHILE much attention has been given to the formulation of paints with a view to economically producing a satisfactory coated surface that will dry within a specific time, retain its colour and have a reasonably good length of life, the preservation of paint from the biological point of view is often neglected. It is now generally recognised that mould growths on painted surfaces are responsible for many faults previously attributed to other causes. Fungi may cause discoloration and serious loss in film strength. In factories producing foodstuffs, breweries, etc., the growth of wild yeasts and moulds on walls is particularly undesirable since it increases the danger of contaminating the products being manufactured.

Mould growths on painted surfaces are especially severe in places where the air is kept warm and humid. These conditions occur in many factories and also in buildings such as indoor swimming baths, greenhouses, laundries, etc. Similar conditions exist outdoors in many tropical countries, and experience in Burma and the Far East during the Second World War has emphasised the need for effective preservatives not only in oil paints or distempers, but even in lacquers and varnishes used in these areas. Water paints and distempers are particularly prone to attack by fungi. They frequently contain either glue or casein, both of which readily support mould growth under warm and humid atmospheric conditions. They are also liable to decomposition through bacterial action.

Research work and practical experience has shown that there are two types of preservative which are very efficacious in the preservation of paints, etc., and have proved effective in preventing coatings being attacked by fungi and bacteria in many different types of atmosphere. These preservatives are pentachlorophenol and sodium pentachlorophenate, manufactured by Monsanto Chemicals Ltd., under the registered trade names "Santophen 20" and "Santobrite" respectively. These products are toxic to a very wide range of micro-organisms, while their low cost and desirable physical and chemical properties render them of great value to the paint and allied industries.

The amount of a preservative required for a paint depends on the formulation of the paint; consequently, the optimum quantity of preservative to be added can be determined only by practical test. Either pentachlorophenol or sodium pentachlorophenate may be used, the choice depending largely on the particular paint formulation.

Pentachlorophenol can be incorporated by dissolving it in the paint oils, solvents or thinners, but the sodium salt is not easily dissolved in such mediums and is commonly incorporated by grinding in with the pigments. Between 1 per cent. and 2 per cent. of either of these chemicals calculated on the weight of the finished paint will usually prove sufficient. At the higher concentrations it is sometimes found that pentachlorophenol retards the drying of the oils, and in these instances it may be better to use the sodium compound. The nature of the pigment used appears to have some effect on the proportion of preservative required. It is sometimes an advantage to use sodium pentachlorophenate rather than pentachlorophenol in light-coloured paints.

Lacquers and Varnishes

The addition of a fungicide to a lacquer or varnish is normally required only where protection against tropical conditions is essential. For this pur-

pose pentachlorophenol is dissolved in xylol, benzol, toluol or other convenient solvent and added to the lacquer or varnish during manufacture. Quantities sufficient to give between 1 per cent. and 2 per cent. by weight of pentachlorophenol in the finished product are generally considered adequate; but as in other cases, practical tests are necessary to determine the minimum effective concentration required to give protection under the conditions of service of the finish.

Distempers and Water Paints

The choice between sodium pentachlorophenate and pentachlorophenol for water paints and distempers depends mainly on the method by which the preservative is to be incorporated. In oil-bound distempers it may be convenient to use pentachlorophenol dissolved in the oil. Where this is not convenient, or where the particular oil used is not a good solvent for this preservative, its sodium salt may be applied to the water phase of the distemper. Where sodium pentachlorophenate is used rather than pentachlorophenol, it is desirable to avoid milling it with dry pigments except in properly enclosed equipment, because there is a likelihood of the dust from the preservative being dispersed into the atmosphere. This dust is irritating to the nose, eyes and mucous membranes generally. Where milling is necessary it is sometimes possible to add a small proportion of some suitable oil to control the dusting tendency.

The concentration of sodium pentachlorophenate or pentachlorophenol needed for preserving water paints or distempers varies even more widely than in the case of other formulations. The nature of the pigments used has a marked effect on the amount of preservative needed; which may vary from as little as 0·2 per cent. in the exceptional cases to as much as 3 per cent. or even 4 per cent. by weight of the finished paint. In general, the minimum effective concentration for fungicidal paints will be found to lie in the region of 1·0 per cent. Ministry of Supply Specification CS.2090/C, for instance, covers the use of 1·0 per cent. "Santobrite" on water paint for Service use in the tropics.

Solubility

While sodium pentachlorophenate is readily soluble in water, about 2 lb. per gal., or 200 grams per litre, pentachlorophenol is practically insoluble in water at room temperature but is soluble in a number of organic solvents. The accompanying table gives a selection of solvents in which pentachlorophenol is soluble, and thus will be of practical help to paint manufacturers. This list of solvents is arranged to depict the solvents in approximate order of decreasing solvency at 30° C.

SOLUBILITY OF PENTACHLOROPHENOL.

Solvent	*Per cent. pentachlorophenol on weight of solution at indicated temperature*		
	10°C.	20°C.	30°C.
Methanol ...	48·0	57·0	65·5
Diethyl ether ...	45·8	52·9	60·3
Butyl carbitol ...	39·5	48·0	57·0
Ethanol (95%) ...	43·0	47·5	52·0
Pine oil	28·0	32·0	35·5
Carbitol	—	30·0	40·0
Diethylene glycol	—	27·5	52·5
Cellosolve ...	17·0	27·0	37·5
Acetone	13·3	21·5	33·4
Xylene	11·0	14·0	17·5
Cottonseed oil ...	10·8	14·8	17·0
Dioxane	5·5	11·5	16·0
Linseed oil (raw)	10·2	13·9	15·4
Toluene	8·5	11·5	15·0
Soya bean oil ...	3·8	12·4	14·9
Benzene	—	11·0	14·0
Tung oil	3·5	11·2	13·5
Ethyl benzene ...	6·5	8·5	11·5
Ethylene glycol ...	—	6·0	11·5
Dipentene ...	7·1	8·4	10·3
Turpentine ...	1·6	3·0	4·4
Carbon tetrachloride ...	0·8	2·0	3·1

Chemical Properties

Pentachlorophenol combines with caustic alkalis to give corresponding salts which are water-soluble. The sodium salt is converted to the insoluble pentachlorophenol at *p*H values below 6·8. Insoluble metallic salts are formed by the addition of sodium pentachlorophenate solutions to solutions of most metallic salts. The copper, silver, lead and mercury salts, which are all insoluble in water, may be prepared by this method. Pentachlorophenol and its sodium salt—sodium pentachlorophenate—are relatively inert and very stable compounds. Neither is decomposed by prolonged heating at temperatures up to 300° C. Pentachlorophenol does not readily

react with phosphorus oxychloride, nor does it undergo the coupling or substitution reactions common to most of the phenols. The free phenol and its sodium salt are, however, attacked by strong oxidising agents. For example, they are oxidised to chloranil and chloropicrin by fuming nitric acid. Both pentachlorophenol and its sodium salt are decomposed slowly by ultra-violet light; but both are non-corrosive to metals including iron, steel, copper and brass.

Neither of these preservatives is a scheduled poison and they are less toxic than many other chemicals in common use, including benzene, strong ammonia solutions, etc. Their effects are not cumulative. If, however, they be accidentally swallowed, either in the solid form or in solution, vomiting should be induced by mustard and water or other emetic and a doctor called. The dust of sodium pentachlorophenate is irritating to the mucous membranes and in making stock solutions, the recommended procedure should be adopted to reduce discomfort to a minimum. Solutions of sodium pentachlorophenate can be slightly irritating to sensitive skins and prolonged contact with the hands is normally avoided. Oil solutions of pentachlorophenol should be treated in the same way, and if gloves are worn, these should be made of oil-resistant synthetic rubber.

BRITISH COLOUR COUNCIL

At the annual general meeting of the British Colour Council held recently, the following officers and council were elected: chairman, A. S. Callaghan (Imperial Chemical Industries Ltd.); vice-chairman, H. Gosling (Cornbrook Chemical Co. Ltd.); honorary treasurer, C. G. A. Cowan (Cowan Bros. (Stratford) Ltd.); council, C. M. Beavis (Golden Valley Colours Ltd.); F. Burrell (J. W. and T. A. Smith Ltd.); A. S. Callaghan (Imperial Chemical Industries Ltd.); C. G. A. Cowan (Cowan Bros (Stratford) Ltd.); H. Gosling (Cornbrook Chemical Co. Ltd.); J. H. Grimshaw (Horace Cory and Co. Ltd.); V. Watson (Cromford Colour Co. Ltd.); H. A. Wilson (The Derby-Oxide and Colour Co. Ltd.); C. E. Young (Hardman and Holden Ltd.); secretary, Allan J. Holden.

ZINC BULLETIN NO. 11

THE opening pages of the *Zinc Bulletin* No. 11, published by the Zinc Development Association, carry interesting news items on some of the major activities of the Association in connection with international conferences and general European co-operation in the major uses of zinc. Other pages draw attention to the capacity of modern hot dip galvanizing plant in coating exceptionally large steel constructional work, an illustrated article on industrial design describes the particular merits of the zinc alloy die casting process which, in the hands of competent engineers and designers, lends itself so admirably to the production of well-designed articles in many different fields.

The role of zinc sulphide pigments in the development of water paints and their value in modern emulsion paints is fully described in a technical article which will be of special interest to all manufacturers and users of interior paints.

Nimonic Alloys—Annealing and Pickling

DUE, no doubt, to the satisfactory results obtained in the gas turbine field from the use of Nimonic 75 for combustion chamber linings, these alloys are becoming well-established in many fields where there is a need for a high-temperature oxidation-resistant material. The two alloys of the Nimonic Series which are most widely used in sheet form are Nimonic 75 and its modified form, Nimonic F.

A new publication, issued by the manufacturers Messrs. Henry Wiggin and Co. Ltd., Wiggin Street, Birmingham, 16, gives up-to-date information on the annealing and pickling of these alloys, replacing earlier fabricating instructions.

G.W.B. Electric Furnaces Ltd. inform us that, owing to the extension of their business to other products, it has been thought necessary to change the title of the company. From 1st January therefore, the company will be known as G. W. B. Furnaces Ltd. The policy and administration of the company and addresses of the company's registered offices, works and branch offices will remain unaltered. The company is still a separate entity, wholly-owned by the proprietors, Messrs. Gibbons Brothers Ltd., of Dudley and Wild-Barfield Electric Furnaces Ltd., of Watford. The products of the company now include electric resistance, arc and induction furnaces; steam raisers and water boilers heated by oil, gas and electricity; electric control gear and case-hardening compounds.

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Diary Notes

Events and Functions of Interest to the Finishing Industry

THE months of January, February and March are always rather busy periods for meetings, lectures, social events, etc., and the present year is proving no exception. The following list, although by no means comprehensive, gives the dates and particulars of the meetings most likely to be of interest to readers of INDUSTRIAL FINISHING.

JANUARY.

27th. Northampton Polytechnic. Corrosion Testing Lectures, No. 3, "The Preparation of Specimens." Lecturer: F. A. Champion, Ph.D., A.R.C.S., F.I.M. (The British Aluminium Co. Ltd.).

The first and second of this series were given on 6th and 13th January. The complete course consists of seven lectures all on Wednesday evenings. The fee for the course is £1 11s. 6d. and enrolment can be effected by application to J. E. Richardson, Ph.D., B.Eng., M.I.Mech.E., Principal.

29th. I.M.F. Meeting, Grand Hotel, Sheffield. Paper and discussion. "Rectifiers and Plating Shop Power Supplies," by I. T. Watkins.

29th. Oil and Colour Chemists' Association, Royal Hotel, College Green, Bristol 1. 7 p.m. Paper, "The Psychology of Colour," by R. H. Peters, Ph.D. (I.C.I. Ltd.).

FEBRUARY.

2nd. I.M.F. Meeting, James Watt Memorial Institute, Birmingham. Paper, "Performance Testing of Paint Films," by R. J. Brown, F.I.M., A.I.Mech.E.

3rd. Northampton Polytechnic. Corrosion Testing Lectures, No. 4, "The Atmospheric Corrosion of Uncoated Metals." Lecturer: J. F. Stanners, B.Sc. (British Iron and Steel Research Association).

4th. Oil and Colour Chemists' Association, Neville Hall, Newcastle-upon-Tyne. Paper, "Cathodic Protection of Steel," by K. A. Spencer.

10th. Northampton Polytechnic. Corrosion Testing Lectures, No. 5. "The Immersed Corrosion of Uncoated Metals." Lecturer: G. H. Botham, B.Sc., F.R.I.C. (The A. P. V. Co. Ltd.).

15th. I.M.F. Meeting, London Section, Northampton Polytechnic. Discussion, "Technical Education: "How It Can Help You." Introduced by J. E. Garside, Ph.D., M.Sc.(Tech.), A.R.I.C., F.I.M.; H. A. Manning; L. L. Shreir, Ph.D.(Lond.), F.R.I.C.

17th. Northampton Polytechnic. Corrosion Testing Lectures, No. 6. "Tests for the Selection of Protective Coating." Lecturer: S. C. Britton, M.A. (Tin Research Institute).

18th. I.M.F. Meeting, Engineers' Club, Manchester. Paper, "Phosphating," by R. F. Drysdale.

19th. I.M.F., Grand Hotel, Sheffield. Annual Dinner and Dance of the Sheffield and North-East Branch.

24th. Northampton Polytechnic. Corrosion Testing Lectures, No. 7. "The Assessment of Corrosion." Lecturer: F. A. Champion, Ph.D., A.R.C.S., F.I.M. (The British Aluminium Co. Ltd.).

27th. London Section, Society of the Chemical Industry, and London Section of the Royal Institute of Chemistry, Joint Annual Buffet Dance, Caxton Hall, London, S.W.1.

MARCH.

2nd. I.M.F. Meeting, James Watt Memorial Institute, Birmingham. "Symposium of Modern Chromium Plating," by A. Wallbank, B.Sc., F.R.I.C., and C. Wharrad.

9th. I.M.F. Meeting, Regent House, Colmore Row, Birmingham. Paper, "Epoxide Resins in Metal Finishing," by R. N. Wheeler, B.A., A.R.I.C.

22nd. Second National Factory Equipment Exhibition, Horticultural Halls, Westminster, deals with mechanical handling, packaging, protection for storage, etc.

26th. I.M.F. Meeting, Grand Hotel, Sheffield. Paper, "The Enigma of Chromium Plating," by N. A. Tope, A.I.M., A.M.I.P.E., A.C.T.(B'ham.).

MOND NICKEL FELLOWSHIPS

THE Mond Nickel Fellowships Committee announces the following awards for 1953:

J. E. Benson (Metropolitan-Vickers Electrical Co. Ltd., Manchester) to study the technique and interpretation of results of non-destructive testing of metal components in the United Kingdom, on the Continent and in the U.S.A. and Canada.

K. Blackburn (Dorman, Long and Co. Ltd., Redcar) to study hot-metal basic open-hearth practice in Great Britain, on the Continent and in the U.S.A. and Canada, with particular reference to mixer furnace operation, refractories, instrumentation and pitside practice.

N. B. Pratt (Broken Hill Proprietary Co. Ltd., Newcastle, N.S.W.) to study the technical and economic aspects of recent advances in the erection and operation of integrated iron and steel works in Great Britain, on the Continent and in the U.S.A. and Canada.

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Items in the following list of manufacturers' literature are available as a personal service to readers of INDUSTRIAL FINISHING *by using the reply card below.*

In addition, the editorial staff of INDUSTRIAL FINISHING *are always available as an advisory service on questions affecting finishing.*

Hard-wearing Paint Finish for concrete floors. A paint specially prepared for application to concrete, cement, etc., applied by brush, two coats normally required, available in six colours; folder describes and shows colours. Silexine Paints Ltd., Richford Street, Goldhawk Road, London, W.6. (222)

Protective Clothing made from P.V.C. Eight-page booklet describes and illustrates a range of this clothing made from fabric-supported P.V.C. resistant to acids, alkalis, fats, oils, solvents, greases, etc. Northide Ltd., Impervia Works, Queen Street, Stockport, Cheshire. (223)

Electrographic Testing Set for the pocket. A simple method for the identification of metals and metallic alloys, the test takes one minute or less and is described in a special folder. Baird and Tatlock (London) Ltd. (224)

Voltage Regulating Equipment. An eight-page, four-fold leaflet, gives illustrations and details of a wide range of transformers, regulators, controllers and constant voltage units. Foster Transformers Ltd., South Wimbledon, London, S.W.19. (225)

Harshaw Perflo Nickel Process. A plating process which is claimed to give smooth, economical coatings on base metal. It has the property of filling in scratch marks and can save up to 50 per cent. of polishing and buffing costs. M. L. Alkan Ltd., Long Drive, Greenford, Middlesex. (226)

Glandless Acid Valve. Plug type, designed to supersede the ebonite plug cock for controlling the flow of corrosive liqueurs. It is provided with both plug and diaphragm and is thus perfectly safe. A leaflet illustrates the construction. Nordac Ltd., Cowley Mill Road, Uxbridge, Middlesex. (227)

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233	234	235	236	237	238	239	240	241	242	243	244	245	246	247	248	249	250				

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READER SERVICE

Paint Systems for Pretreated Surfaces. The application of paint coatings in conjunction with the use of phosphating and pretreatment is described in a small booklet issued by Jenolite Ltd. It gives details of the methods recommended for steelwork, ship hull, general paint coatings, etc. Jenolite Ltd., 43 Piazza Chambers, London, W.C.2. (228)

Plastic Emulsion Coating. Quick drying, scrubbable, and with no unpleasant odour. Detailed information and a Table of specifications. Silexine Paints Ltd., Richford Street, London, W.6. (229)

Plaster and Cement Gun. The method of applying plaster, cement, etc., to walls by the use of an atomised water spray is described and the gun illustrated in a data sheet issued by the makers. The J. E. Morgan Cement Gun Co., 149 St. Ann's Road, Tottenham, London, N.16. (230)

Electronic Controller. Suitable for solenoid valve or motor operation, on gas-fired and oil-fired furnaces, or contactor operation on electric furnaces. Illustrated leaflet gives full details and information on methods of application. Kelvin and Hughes (Industrial) Ltd., 2 Caxton Street, London, S.W.1. (231)

Pump for Viscous Material. An air-operated pump designed to give a steady flow of fluid of very high viscosity, such as paint, bitumen, grease, etc., at pressures up to 800 or 1,000 lb. p.s.i. Charles S. Madan and Co. Ltd., Vortex Works, Broadheath, Altrincham, Cheshire. (232)

Lead in Chemical Engineering. A booklet describes the use of lead in lining wooden vats, covering immersion heaters, fabrication into coils, tube forms, etc. Nordac Ltd., Cowley Mill Road, Uxbridge, Middlesex. (233)

Belt Grinding and Polishing Machine. Costing only £48, the machine described in this leaflet is of robust construction and can be switched from the horizontal to the vertical position at will. The G.M.P. Co. Ltd., Queensbury, Bradford, Yorks. (234)

Adjustable Pantograph Engraving Machine. A three-dimensional pantograph machine (reduction $\frac{1}{1}$-$\frac{1}{8}$) for reproducing characters and designs homothetic with those of the pattern or template. Folder gives illustration and details. Acbars Ltd., Cecil House, 57a Holborn Viaduct, London, E.C.1. (235)

Steam-operated Tank Heater. Reduces steam consumption, saves time in heating and promotes rapid circulation in the

(*Continued on page* 441.)

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tank. Folder. Ward's Patents Ltd., Old Colony House, South King Street, Manchester 2. (236)

Submerged Combustion. A leaflet contains a full description and diagrams of the Swindin submerged combustion system. The feature of instantaneous heat transfer is described. Nordac Ltd., Cowley Mill Road, Uxbridge, Middlesex. (237)

Off-peak Heater for Offices, etc. An electric storage type heater is described in this leaflet. It gives out heat during the day and is charged at night during off-peak load times and usually at cheap rates. Thermodare (Great Britain) Ltd., 79-80 Petty France, London, S.W.1. (238)

Silicones in Electrical Varnishes. A fourteen-page brochure is available giving particulars of the advantages and methods of employing silicone fortified varnishes in electrical winding work. Midland Silicones Ltd., 19 Upper Brook Street, London, W.1. (239)

Pressure Gauges. Leaflet describes a range of pressure gauges to meet all requirements. Finished in crackle, chrome plate, or a range of paint colours. Plastic "glasses" and zero setting device if required. Barnet Instruments Ltd., Bath Place, Barnet, Herts. (240)

Portable Deadweight Tester for pressure gauges. Well-illustrated folder gives details and shows testing methods used. Barnet Instruments Ltd., Bath Place, Barnet, Herts. (241)

Bright Nickel Plating. The Harshaw bright nickel process is described in a folder which also gives full details of the possible savings inherent in the process. M. L. Alkan Ltd., Long Drive, Greenford, Middlesex. (242)

De-watering Oils. Thirty-two-page booklet with photographic illustrations deals with the nature, use and application of de-watering oils. Many diagrams and examples of applications. W. B. Dick and Co. Ltd., 43 Grosvenor Street, London, W.1. (243)

Stone Paint for Outside Walls. Descriptive brochure on the use and nature of special paints for use on exterior stonework. Silexine Paints Ltd., Richford Street, Goldhawk Road, London, W.6. (244)

Turbo Exhausters and Blowers. Machines for vacuum of 2-10 in. mercury and pressures from 1-6 lb. p.s.i. A leaflet gives details and diagrams of construction. Sturtevant Engineering Co. Ltd., Southern House, Cannon Street, London, E.C.4. (245)

A New Angle on Ladders. This small folder gives some interesting examples of the use of a special ladder fitment for holding a ladder away from the working surface. Ferrous Products (London) Ltd., 110 High Street, Croydon, Surrey. (246)

Industrial Gloves. Another of the series of booklets issued by a firm specialising in protective clothing. The range covers almost every requirement and the folder carries many illustrations. Northide Ltd., Impervia Works, Queen Street, Stockport, Cheshire. (247)

Visible Record Cabinets. Leaflet, in colour, describes the advantages of the Bulmerdex system of record cards, indicators and cabinets. Bulmer's Systems, Bulmer's Calculators Ltd., 7-8 Poultry, London, E.C.2. (248)

Pneumatic Message Conveying System. A system of message transmission through pneumatic tubes incorporating electronic traffic control. A sixteen-page folder describes and illustrates the system. Dialled Despatches Ltd., Eagle House, Jermyn Street, London, S.W.1. (249)

Portable Hardness Tester. A pyramid diamond indenter type hardness tester which is fully portable. It weighs approximately 18 lb. and applies its load by hydraulic means. Brochure gives details and illustrations. C. Tennant Sons and Co. Ltd., 4 Copthall Avenue, London, E.C.2. (250)

A WORD OF EXPLANATION

THIS Reader Service Section was started in INDUSTRIAL FINISHING over six months ago. Since then we have sent out literally hundreds of items of manufacturers' literature to interested readers.

It is run in the mutual interest of readers and manufacturers as a personal service to both. No charge is made to a manufacturer for the inclusion of his material, in fact this is invited, and no charge is made to the reader for the service. It is simply and solely for his convenience to save him writing to dozens of different manufacturers for individual items. Should he wish, however, he can write to the manufacturer direct; the address is always given.

THE IMPORTANCE OF PAINT

by R. A. W. OTTLEY*

"Finishing materials, in addition to contributing to the attractive appearance of the product, offer the first line of defence against destructive agencies. . . ."

THE importance of paint to industry, and the method of obtaining the best results, were the subjects chosen by Mr. R. A. W. Ottley, industrial finishing technical representative of I.C.I. Paints Division Ltd., when he addressed members of the Institute of Metal Finishing at the Engineers' Club in Manchester a week or two ago.

Mr. Ottley, in his paper "Organic Finishes," said that for the past twenty years many kinds of new paint had come into industry as compared with the old type of oleoresinous products, and now it was common to use synthetic finishes which were superior in many respects to the natural product, although the latter still had its uses in certain finishing procedures.

He explained that there are five main classes of materials produced by the paint industry (a) orthodox oil and varnish paints, (b) synthetic finishes, (c) cellulose finishes, (d) decorative water paints and emulsion materials, and (e) sprayed varnish enamels.

In addition to describing these materials, Mr. Ottley gave his audience an insight into the use of pigment and its suspension in liquid, while he also covered the use of extenders and special pigments which give corrosion-resisting properties.

"Pigment," said Mr. Ottley, "is the solid content of the material which gives colour and opacity, or hiding power.

"Vehicle is the liquid content of paint, oil varnish or emulsion type, and it is the vehicle that acts as a binder for the pigment as well as being responsible for the adhesion of the paint to whatever article it is applied."

Oil varnishes, or vehicles, as well as synthetic vehicles, were enlarged upon and particular reference was made to the manufacturing differences between the oleoresinous and the synthetic type materials.

The use of solvents and driers used in these products were also covered, Mr. Ottley explaining that solvents were necessary to adjust the viscosity of the material which assists in application by either brushing or spraying. Driers, he explained, regulate the speed of drying, and the materials first dry by the evaporation of solvents, and then by oxidation. The drying mechanism of both normal air-drying products, and stoving versions was explained.

Mr. Ottley said that the word synthetic was now loosely applied to a wide class of finishes, and that it could be misleading, giving the impression that it was inferior to the natural resin-containing products. "This was not true," he said, "for the term synthetic has been adopted in general since no really satisfactory alternative has been put forward."

In dealing with cellulose finishes, he again emphasised the difference between cellulose finishes and oil or synthetic paints, and pointed out that cellulose finishes dry entirely by the evaporation of the volatile solvents. Cellulose products, he said, were particularly suitable for spray application, although normally the drying of these materials for application by brushing was so fast that the use of brush application was limited. But specially-formulated brushing cellulose enamels were obtainable.

It was stated that while cellulose finishes developed quite a hard film, they lacked "build" compared with the oil or synthetic type finishing materials. Also, Mr. Ottley stated, cellulose materials were obtainable in primer, putties, fillers and sealers, in addition to top coat or final finishes.

Mr. Ottley fully described the functional characteristics of paint materials, and explained that with primer the essential purpose was to ensure ade-

** Report on a paper read to the Organic Section of the I.M.F. in Manchester.*

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quate adhesion of the complete paint systems to the surfaces to which it is applied.

In addition, it should contribute to the general resistance and mechanical strength of the complete film, and have some positive corrosion-resisting properties.

A primer is normally formulated to be applied as a thin coating which may be applied by dip, spray or brush, according to the requirements. Referring to putties and fillers, Mr. Ottley described them as heavy bodying materials which were used for the purpose of filling, deep indentation, or surface defections in the metal or cast-iron. Knifing fillers, he said, are generally adopted in processing heavy castings, and here particular reference was made to the machine tool industry.

Primer surfacers and surfacers were described as being a half-way media between a primer and filler, being not so heavily bodied as a filler, but giving greater "build" than a straight primer. The main use of a primer surfacer was to achieve faster processing time, and where certain characteristics obtained with separate primer and filler could be sacrificed, the primer surfacer could be used with extreme success.

In respect of finishing materials Mr. Ottley pointed out that in addition to contributing to the attractive appearance of the finished article, they offered the first line of defence against destructive agencies and it was emphasised that it was important to select the most suitable finishing material under conditions in which it was expected to perform.

The difference between the requirements of a finish applied to refrigerators, washing machines and other kitchen equipment which had to withstand a humid atmosphere, and that applied to toys, etc., was fully explained, along with the danger of indiscriminate mixing of materials and processes.

Dealing with application, Mr. Ottley said that there are many methods of applying paint, and mentioned such procedures as spray, brush, dip, roller coating, flow coating, tumbling and electrostatic deposition, all of which were of value for particular types of work. One of the main considerations, he said, was the fact that the products from the engineering and metal industry were designed and produced with meticulous care, and that good finishing was, therefore, essential if the article was to catch the consumer's eye.

Particular stress was laid on having a sound knowledge of the surfaces to be treated, and Mr. Ottley pointed out that insufficient "fettling" of castings would lead to high finishing costs and not altogether a satisfactory process. Steel or aluminium surfaces with deep file marks, dents and scores, or any kind of superficial abuse would also lead to increased finishing costs.

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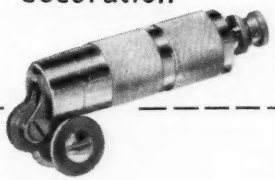

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That it was necessary to provide a surface thoroughly clean was fully emphasised, and here a number of degreasing agents were mentioned, along with a description of chemical derusting and shot and sand blasting. Regarding the chemical treatment of steel and zinc, it was mentioned that phosphates were used, whereas for aluminium and its alloys chromates are principally employed.

Camouflage finishes were also covered, the main consideration here being the minimum of finishing coats, and at the same time a finish that appeared satisfactory and with a sales appeal. Spatter, crackle, wrinkle and hammered metal finishes were also described.

In an open discussion that followed, Mr. Ottley, in reply to an American visitor who asked if there was a suitable paint material for lining *in situ* tanks which contained glycol, said that it was quite a difficult problem to find a really suitable paint material to withstand glycol, and it chiefly depended upon the surface condition of the steel being coated, the ultimate applied film thickness of the resistant material, together with the hardening period when the material would become more or less inert.

Resistant linings were available, however, but these would have to be applied on the premises of the company concerned where proprietary lining processes were available.

Another questioner asked if there was a satisfactory paint finishing process for water heater units, since he had been let down badly by paint on changing from vitreous enamel.

Mr. Ottley replied that despite the unsatisfactory results that the questioner had obtained on changing to paint from vitreous enamel, there was undoubtedly a satisfactory system.

Surface preparation of the metal and the correct selection of primer and finish would result in a satisfactory answer to his problem, said Mr. Ottley.

THE NICKEL INDUSTRY IN 1953

DEMAND for nickel throughout the free world in 1953 continued at a high level, with defence needs again restricting the amount of the metal available for civilian applications, Dr. John F. Thompson, Chairman of the Board of Directors of The International Nickel Co. of Canada, Ltd., stated recently in a year-end review of the nickel industry.

"It is estimated that almost half of the production of the free world during the year was allocated for its military, atomic energy and stockpile requirements," Dr. Thompson said. "Over 65 per cent. of this 1953 output went to the United States for both defence and civilian purposes.

"Production of nickel by the free world is expected to approximate 340,000,000 pounds this year, an increase of about 20,000,000 pounds over 1952, and 50,000,000 pounds over 1951," he continued. "Canadian output, it is estimated, will reach 285,000,000 pounds in 1953, or about 85 per cent. of the free world's total production.

Controls Relaxed

"Governmental restrictions on the allocation and end uses of nickel in various countries, which had been in effect for several years, were substantially relaxed in 1953. The relaxation of controls occurred as a result of the progressive decrease in military demands, commencing in mid-year, and the maintenance of a constantly high level of nickel production throughout the year.

Applications

"Applications of nickel in 1953 were necessarily influenced by government restrictions prevailing during most of the year. The steel industries of the United States, the United Kingdom and Canada, in the production of stainless steels, engineering alloy steels, and jet engine alloys, were again the largest consumers of nickel.

"In the distribution of nickel which, during most of the year, was under government allocations, the *nickel-plating* industry did not receive a sufficient quantity of the metal to maintain pre-Korean practice in respect to the thickness of coatings. The nickel supply for plating became somewhat better by the latter part of the year through increased allocations made both before and after government nickel controls were relaxed.

"Manufacturers of *nickel silver*, since the relaxation of controls, are returning to the production of the 18 per cent. nickel-containing grades of this copper-nickel-zinc alloy to the extent permitted by supplies of nickel. Prior thereto, the percentage of nickel allowable, even in permitted uses of this alloy, had been radically reduced and many applications prohibited entirely.

"Production of *cupro-nickel* alloys during the year for both the 10 per cent. and 30 per cent. nickel grades showed an increase, particularly in recent months.

"*Nickel-chromium alloy castings* are

essential in heat-treating furnace equipment for both the maintenance of existing facilities and the installation of new units. A significant amount of nickel was employed in this field during 1953.

"*Ni-Hard,* the abrasion-resisting nickel-chromium cast iron, continued to serve in essential applications for grinding balls in the mining, cement and paint industries. *Ni-Resist,* the corrosion-resisting nickel alloy cast iron, was again used in components of industrial equipment where resistance to corrosion, heat and wear is required.

"The *magnetostrictive property of nickel* continued to arouse interest in widening fields. One of the first applications of this interesting characteristic of nickel was in depth-finding instruments on ships, which was later expanded to "Sonal," an ultrasonic submarine detecting device. During the year several new fields employing this principle have been developed, including such diversified applications as an electronic machine tool capable of cutting intricate shapes in the hardest materials, oil well drill bits which markedly increase drilling rates in hard rock, a burglar alarm, and a device for detecting whales and schools of fish.

"Much of the expected 1954 world production increase is under contract by the United States Government and will be delivered to it for defence and stockpile purposes. Whether the supply in the United States for civilian purposes will improve or lessen will depend upon changes in the military requirements and whether the United States Government makes diversions to the stockpile out of nickel supplies which heretofore have been made available for civilian consumption."

British Visqueen Ltd., the joint company to manufacture polythene film formed by Imperial Chemical Industries Ltd. and the Visking Corporation of Chicago, Illinois, will commence trading during February, 1954. Its products will include "Visqueen C," a special film which overcomes the problems of ink adhesion on polythene film.

British Visqueen's new plant and offices being built at Stevenage will not be completed until July or August of 1954. In the meantime, the company's headquarters will be at 94 Tewin Road, Welwyn Garden City, and plant is being installed in temporary premises at Hillhouse in Lancashire .

The formation of British Visqueen Ltd. was announced in July, 1953. The company's authorised capital is £240,000, two-thirds of which is held by I.C.I. and one-third by the Visking Corporation.

A Building Research Digest, No. 58, has been published covering the subject of prevention of condensation on walls and ceilings. Among the paints with which it deals are chlorinated rubber, p.v.a., styrene emulsion and alkyd paints, and textured plastics. Their properties are compared in a table, where their respective absorptions can be seen at a glance. The Digest is available at H.M. Stationery Office, price 3s.

Furane Resins are now being marketed by Leicester, Lovell and Co. Ltd., North Baddesley, Southampton, manufacturers of casein glues and synthetic resins. The range is known as "Cascote" furane resin.

"Wiggin Nickel Alloys" No. 23 reviews work carried out on crop drying by electricity, a major development in farming. Types of industrial heating elements, ultra-violet and infra-red ray radiation, filtration, incubation, cathode ray tube seals, temperature control, electrical upsetting and the introduction of Nimoply are other subjects dealt with. Copies of this journal may be obtained free of charge by writing to Henry Wiggin and Co. Ltd., Thames House, Millbank, London, S.W. 1.

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NAMES IN THE NEWS

Appointments

John Hall and Co. (Warminster) Ltd., paint manufacturers, have appointed **Mr. J. A. B. Wilkins** a director of the company. Mr. Wilkins has had 28 years' experience in the industry and the appointment was made to coincide with the fifth anniversary of his service with the company.

It is announced that **Mr. A. J. Haslam,** who has been connected with the plating trade for a number of years, has now joined the laboratory staff of the Radiant Metal Finishing Co. Ltd.

Monsanto Chemicals announce that, with effect from January 1st this year, the present general manager of sales, **Mr. D. R. Mackie,** is to be commercial manager of the company. The position of general sales manager will be discontinued, and the responsibilities of that office transferred to three sales controllers: **Mr. E. L. Pixton, Mr. D. C. M. Salt** and **Mr. J. S. Hunter. Mr. W. M. Thompson** has been appointed director of purchases.

Mr. D. N. Scott has been appointed a director of Sherwoods Paints (Scotland) Ltd., he is at the Cambuslang, Lanarkshire, Factory.

Mr. Ernest G. Brooks has been appointed General Manager of the Gas Division of Thomas De La Rue and Co. Ltd. Mr. Brooks was General Manager of Thomas Potterton's (Heating Engineers) Ltd. under the joint Managing Directorship of the Brothers T. F. C. and A. B. Potterton when the Company joined forces with De La Rue. As General Works and Technical Manager, he has been responsible for some important technical developments in De La Rue's gas-fired equipment during recent years and is known to many members of the Gas and Stoving Oven Industries for his informal technical talks.

Mr. E. G. Brooks

The United Steel Companies Ltd. announce that they have appointed **Commander K. H. S. Cohen, C.M.G.,** as their European adviser. For some time the company has wished to make a closer study of the trends in European industry and economics and Commander Cohen is to undertake this work on their behalf.

Following the appointment of **Mr. L. W. Dennis,** formerly commercial manager, as managing director of Cape Asbestos (Canada) Ltd., in Toronto, The Cape Asbestos Co. Ltd., of London and South Africa, announce the following appointments:

Mr. A. G. Grant, commercial manager (home).

Mr. M. H. Reid, commercial manager (planning and overseas).

Mr. M. A. F. Newton has been appointed personal assistant to **Mr. K. C. Gray** recently appointed director (sales); and **Mr. H. Barty-King** has succeeded Mr. Newton as publicity manager. **Mr. N. A. C. James** has become manager, southern area sales, in place of Mr. Grant.

Mr. P. Worledge and **Mr. P. A. Denison** remain in charge of "Capasco" brake lining and "Asbestolux" building board sales departments respectively.

Mr. M. H. Reid

Mr. Grant joined the head office of the company, then at King Street, E.C., in 1924; Mr. Reid became assistant secretary in 1949 and since 1950 has been manager of the company's Turin subsidiary, Capamianto, S.p.A.

Mr. A. G. Grant

Mr. K. C. Gray

RETIREMENTS

After more than forty-eight years service with Robert Kearsley & Co., **Mr. R. G. Tattersall** retired on 31st December, 1953. Joining the Company as a young man straight from school, he has, during his lengthy period of service, watched the growth of the business from the comparatively small enterprise in 1905 to the modern, well-equipped, and spacious factory that exists today. Coupled with the duties of Company Secretary, he was primarily responsible for the export side of the business, and through his continuous efforts, a substantial volume of trade has been built upon overseas markets.

Mr. R. G. Tattersall

Mr. W. J. Millar, who was managing director of Efco Engineering Co. Ltd., joint managing director of Electric Resistance Furnace Co. Ltd., and a director of Electric Furnace Co. Ltd., and Electro-Chemical Engineering Co. Ltd., retired on 1st January, 1954, having reached retiring age.

During the 34 years which he has spent with the Efco Group, Mr. Millar has done much to develop the companies' activities, particularly on the Resistance Furnace side and in the planning and organising of Efco Engineering Co. Ltd.

Mr. Millar received his technical education at the City and Guilds of London Technical College. In 1919 he entered the electric furnace industry, then in its infancy, under Mr. D. F. Campbell, chairman of the Efco Group.

Francis F. Jaray, who recently set up as a consulting engineer specializing in the design and development of chemical plant and corrosion-proof materials, has now established another office at 6 Sansome Place, Worcester. Tel. 5369.

Dr. W. A. Baker, research manager of the British Non-Ferrous Metals Research Association, has been awarded the degree of D.Sc. of London University.

The canteen of the Wembley, London, works of Messrs. Bratt Colbran Ltd. was, on the afternoon of Saturday, 2nd January, the very crowded scene of the annual children's party, when around 175 children were entertained to tea, and saw a pantomime.

This children's party, which has now taken place for a number of years, is organised by the works social club and run by the club committee. The photograph shows Mr. Lawrence Bratt, Mr. Eric Bratt and some of the children who were present.

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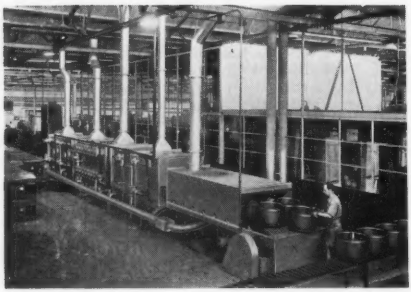

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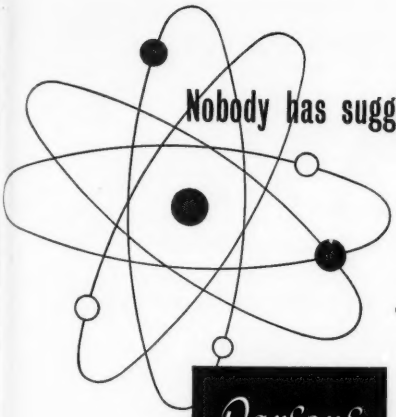

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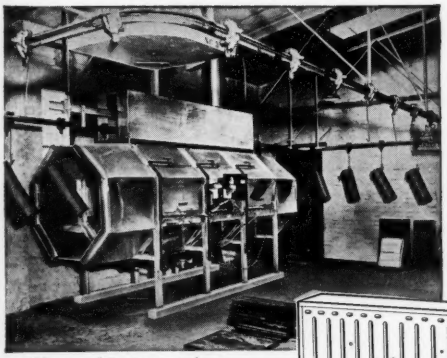

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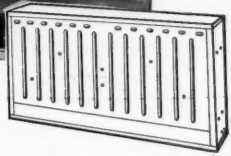

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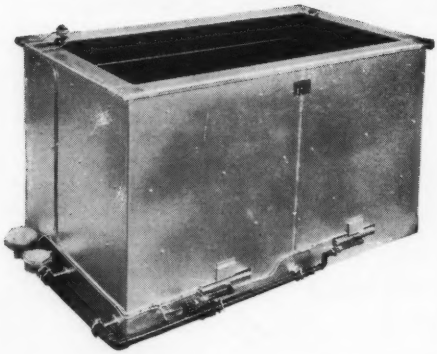

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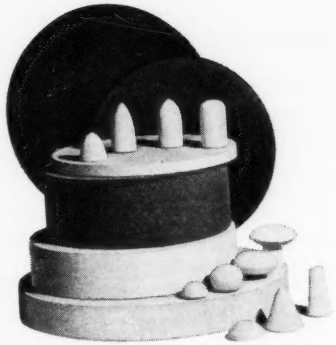

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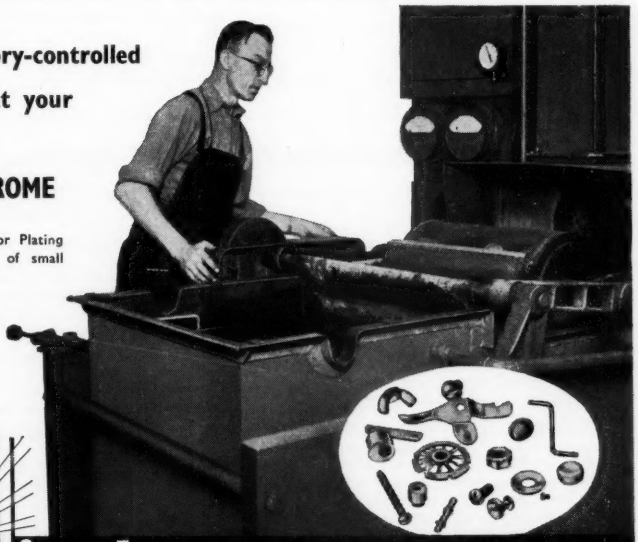

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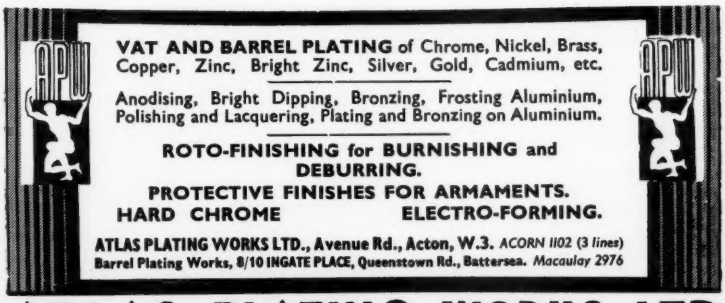
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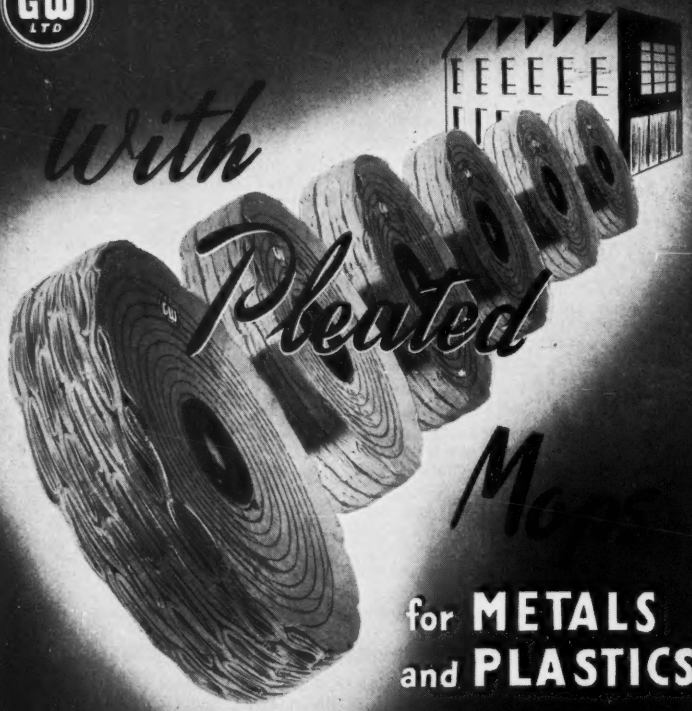

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